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Popular Mechanics

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MUSTANG COBRA R VS. CORVETTE Z06
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Woodworking Guide
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2002 Lincoln Blackwood
The Macungie Car Show
Hall Of Fame Young Leaders
Jaguar F-Type Roadsters
The Firestone Recall

Technology

Buying On The Internet
Interacting With Science In Miami
High-Tech Airline Appliances
Napster: Destructive Downloads
Computer Basics By Kim Komando

Home Improvement

Cooper Tools Web Site
Hobart Makes Bid To Demystify Welding
Choosing The Right Broom
3 Household Problem Solvers
Craftsman Mini Tools

Science

Underwear That Keeps Your Doctor Aware
Computerized Personality Problems
Universal Cancer Vaccine
Out-Of-This-World Design Competition
Evidence Of An Alien Ocean

Outdoors

Gear For The Physically Challenged
Olympic Gold Running Shoes
Comparison Test: 5 Outboard Motors
Honda's Slick New ATV: The Foreman Rubicon 400
Flying Machine

WELCOME TO THE NEW PMZONE

We've given the Zone a new look that will make finding the information you want easier and faster. The more you use the PMZone, the more you'll find it to be an essential resource for research, historical authenticity, and just pure enjoyment. With over 10,000 editorial pages available with just a few clicks of your mouse, you'll find a wealth of information. And while the Zone archives are an invaluable tool, we're not just about history. You'll also learn about what is happening right now, such as the Firestone tire recall, or new computers just out. Five wire service feeds update the Zone every 20 minutes with up-to-the-minute breaking news.

Be forewarned, however. The PMZone may be habit forming.

READER'S RIDES

Got a cool car? Wanna see it on the Internet like Steve Shapiro's '55 Lincoln Capri?

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Editor's Notes

Heroes And Villains

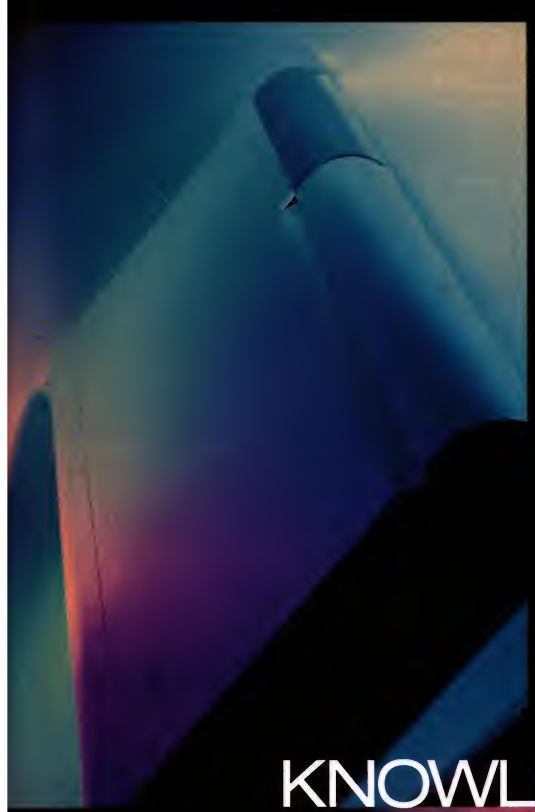
PHOTO BY MARIAN SAVAGE

Heroes Ken Gross (left) and Rich Taylor (right).

Two of our best writers, Rich Taylor and Ken Gross, were recently named Heroes Of The Old Car Hobby by the bible of that industry, *Hemmings Motor News*. How does one become a Hero Of The Hobby? In the case of contributing editor Rich Taylor, it helps that he's been writing about old cars for POPULAR MECHANICS (and other publications) for more than 15 years. Also helping is his staging of vintage car rallies in New England, Texas and California every year. In the case of contributor Ken Gross, it's writing for POPULAR MECHANICS (and other publications) for almost 10 years and also being director of the Petersen Automotive Museum in Los Angeles. Regular readers will know that I'm an old car hobbyist myself. I love old cars, which is probably why the Collector Cars area on the PMZone Web site is one of the biggest and, for me personally, one of the most fun to browse. I salute Terry Ehrich, president of *Hemmings Motor News*, and himself a hero of the hobby, for recognizing those who are helping the old car hobby strengthen and grow. And I thank him for recognizing two from the POPULAR MECHANICS family. ... **So much for heroes.** Now on to the villains. There are environmental extremists in local, state and federal governments who are—right now as we speak—trying to outlaw the restoration, possession and operation of old cars. The grounds? Old cars are an eyesore (to these people). They (supposedly) pollute the air. And people have too much fun playing with them. If you disagree, join us in the fight against these zealots. To find out what's doing in your state, you can go to the PMZone's Collector Cars area, and click on the Legislation button. ... **This month's cover story,** beginning on page 66, may answer decades of questions about unexplained UFO sightings. In our January 1995 cover story, "Flying Saucers Are Real," we uncovered evidence that revealed the U.S. government had, indeed, experimented with disc-shaped flying aircraft. Now science editor Jim Wilson's investigative report slam-dunks the whole story about the U.S. Air Force's flying saucers, which apparently were secretly airborne for more than two decades. Fascinating stuff. ... **More red meat for the Ford guys** and Chevy guys. You've been at each other's throats for years. Now, on page 76, we answer *the* question: Which one builds the quickest car? It's Ford Mustang Cobra R versus Chevrolet Corvette Z06 in a no-holds-barred dragfest at Englishtown. May the fastest car win. ... **You were startled by Apple's** incredible iMac two years ago. Now be amazed by the new Cube, Apple's tiny, squared-off muscle machine. Technology editor Tobey Grumet calls it the fastest—and smallest—personal computer Apple has ever offered. Log on to our review beginning on page 80. ... **If you're one of the thousands** who regularly enter our reader contests, check page 86 for our latest. It's your chance to win perhaps the greatest tailgate unit ever devised by man. As a New York Jets fan and a dedicated Meadowlands tailgater, I can personally attest to the levels of debauchery that are possible with this tailgate unit. Don't wait. Enter now. ... **Calling all woodworking enthusiasts.** First, check page 95 for the start of our annual woodworking guide, possibly the best one we've ever published. Second, on page 119, read about our new *WoodWork* newsletter, published for woodworking enthusiasts only. If you love the tools, the techniques and, most of all, the wood, you're going to love *WoodWork*. Subscribe now. Till next time.

Joe Oldham

BETTER SOUND THROUGH RESEARCH.



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Innovative Features

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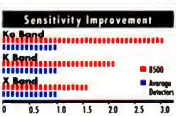
Introducing The Passport 8500

Every once in a while a new product comes along which redefines the standard of performance. The All-New Passport 8500 does just that.

Unbelievable Range

The New Passport 8500 utilizes a totally new design, including a new waveguide antenna, state-of-the-art microwave receiver, and our latest proprietary software. The result is a remarkable increase



in sensitivity, including a blistering 200% improvement on the elusive Superwide Ka-band, and complete immunity to VG2.

One Step Ahead

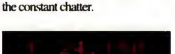
Speed measuring devices continue to improve through the use of new technology. Passport's innovative design allows the on-board microprocessor to be re-programmed to detect new radar and laser units. While other manufacturers' models

Completely New – Inside and Out

become obsolete, the Passport 8500 can be upgraded to protect you against the latest threats.

Less "Noise"

Improving sensitivity typically means an increase in annoying false alarms caused by various automatic door openers and security devices. Passport's advanced signal rejection circuitry, and exclusive "Auto" mode, separates real threats from the "noise." The result is advanced warning without the constant chatter.



New SpecDisplay mode will show you the actual frequency of the radar signal.

Detail Oriented

The Passport 8500 features our exclusive "ExpertMeter" display, identifying band and relative signal strength on up to 8 signals simultaneously. Or choose our new "SpecDisplay" and Passport will show you the actual frequency of the radar signal.

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Letters

Flying Freight Trains

With the many mechanical systems and extensive software required to control a V-44 system, the inherent flight reliability will be so low that no rational company will consider building it. Even if every individual component had a reliability of 99.999 percent, the resultant reliability would still be lower than any previously conceived platform.

TED MORTON
ALEXANDRIA, VA

As we speak, Boeing is considering the project. —Ed.

A flying freight train? I don't think so. Maybe a flying truck. Each empty boxcar on a railroad weighs more than 20 tons. I still enjoyed the story.

CHARLES ALLEN
VIA INTERNET

Roadster Rage

As a longtime subscriber, I felt prompted to write after reading the recent roadster comparison test. You stated that you didn't include the Corvette in the test because it is "a serious sports car" rather than a "funster." This is just plain wrong. Chevrolet has done an excellent job for years making the Corvette the best bang for the buck in the sports car arena, and to not include it here is a gross oversight. As for price, the Audi and BMW are priced in the same ballpark as the Vette, and the Mercedes and Boxster cost more! I have owned three of the cars in the review, and currently own a C5 Corvette roadster. The C5 blows them all away with its combination of comfort and daily driver appeal while still being able to run with true exotics.

WALT SCHEIDERICH
VIA INTERNET

For more on the C5 Corvette, check out the test elsewhere in this issue —Ed.

Jay Sez

As an amateur car restorer, I couldn't agree more with Jay Leno's article on Pebble Beach (see "Getting Ready For Pebble," Sept. 2000, page 48). I can't tell you how many times I've been beaten at car shows by someone who has outspent me 10 times over and had their car professionally restored. The obvious answer is to have two classes: self- and professionally restored. Don't get me going on the jerks who trailer their cars to shows.

JOHN LEE
CANNON FALLS, MN

How about separate classes for the trailer queens and cars actually driven to shows? —Ed.

Today, our colleges are turning out students whose greatest skill is watching mass entertainment. Our educational system demeans and discourages people who work with their hands. When society looks down its nose at the mechanical trades, everyone loses. Maybe Jay's article, and his prominence, can help to change that.

JACK LANGHORNE
VIA INTERNET

Jay used the term "rich guys" not once, but twice. Rich guys? The last I heard, Mr. Leno owns more than two dozen classic cars and who knows how many motorcycles. Rich guys? His salary for one show is probably more than the average Joe makes in 10 years. These Hollywood

Reader Project Of The Month

My wife came home one day with an idea for using the Saltillo and ceramic tile we had left over from a previous project. She likes sun-shaped designs, so I drew up a rough draft of a sun. I thought we could try it in the center of a room with Saltillo tile surrounding it. We decided to install it in the bathroom. As you can see, it really brightened up the room.

JOHN FONTES
GLENDALE, AZ

If your project is chosen as Reader Project Of The Month, you will receive a selection of Popular Mechanics/Wal-Mart tools as a token of our appreciation for sharing your project with us. For your project to be considered, please send a clear, color photo and brief description to: Reader Project Of The Month, Popular Mechanics, 810 Seventh Ave., 6th Floor, New York, NY 10019.

Letters are subject to editing for length, style and format.

(Please turn to page 12)

Car insurance
with no State Farm Agent?
I'm not that brave.

State Farm Customer John Woolard

Alligator specialist John Woolard has no problem wrestling with things that have long, sharp, pointy teeth. But ask him to grapple with some kind of cut-rate car insurance? No way is he brave enough for that. Want to play it safe with your car insurance? Be like John, and go with the reliable service and competitive rates you get with a State Farm Agent.

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types take class envy to new heights. Have they no shame?

TERRY AND SARAH WHITE
VIA INTERNET

Jay Leno owns 43 cars and a dozen motorcycles. He also does most of the mechanical work on them himself. What's more, he sponsors the Fred Duesenberg Scholarship and the Jay Leno/POPULAR MECHANICS Scholarship at McPherson College. He's certainly not a Hollywood-type empty suit. —*Ed.*

Like Jay, I too have had a long love affair with cars. I got my first car at the age of 9 and have since owned over 113 cars and trucks. I wish I still had some of the old

NASCAR
TENNECO Automotive
© 2000 Tenneco Automotive

classics that I once drove, but that's what memories are for. I still own a '57 Chevy four-door that's an everyday driver. Nothing fancy, but still fun to drive.

JOSEPH R. SELL
MORRISVILLE, PA

Gun People

I saw the ad for Ruger in a recent issue. A Ruger Mark II was my first handgun more than 30 years ago. I have since passed it on to my son-in-law who has become interested in target shooting, which we do in safe and controlled conditions. I appreciate the fact that you have not let others politically dictate what advertising your magazine accepts. Our pistol club meeting starts with the pledge of allegiance to the United States flag. Yes, we may like and use guns but we are not bad people, as some in Washington would make you think.

ROBERT M. BROAS
RHINEBECK, NY

I salute you on having the moral fortitude to run a handgun advertisement in your fine publication. Thanks for being unbiased.

TODD GLOVER
VIA INTERNET

Reading In Bed

In her column, "Think It's New?" Mary Seelhorst speculates when mankind first began to read in bed with a night light, and gives a broad range of suggestions. I think I have the answer. My take is that it began 1200 years ago with the publication of the Kamasutra.

ROBERT H. GENTRY, M.D.
KNOXVILLE, TN

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Time Machine

90 Years Ago: November 1910

Sinking Feeling

Shortly before midnight on Sept. 8, the huge, steel car ferry known as the Pere Marquette No. 18 left Ludington, Mich., with a cargo of 29 freight cars, bound for Milwaukee, Wis. She was equipped with every safety device, and yet she foundered in the middle of Lake Michigan just after 7 o'clock the next evening. Survivors reported no collision, no explosion and no fire. This report examined theories as to the cause of the disaster, but the real story remains a mystery.

Air Power

Five thousand horsepower from air bubbles. An extraordinary power plant on the Montreal River in Canada, just south of the mining town of Cobalt, held the title of largest natural air-compressor plant in the world. And it worked by capturing and confining air bubbles. Falling some 351 ft., the river water would trap and compress air particles in its descent. The water/air mix was channeled through pipes of decreasing diameter to further increase compression, and then into larger pipes that decreased the velocity of the flow and liberated the air, which was compressed to 125 pounds per cubic foot. The plant supplied about 4000 cu. ft. of air under 100 pounds of pressure per minute to the Cobalt mining camp.

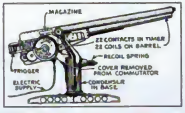
60 Years Ago: November 1940

Car Clairvoyance

Cars of the future will have their engine in the rear—where it should have been all along. So said George W. Walker, auto designer and industrial stylist. Walker also envisioned cars of the future having "living room luxury," including a summer and winter climate-control system. Airplane-type crash pads would protect occupants from the "hard bumps" of road accidents. A spring-mounted bumper running around the body would also help absorb impact force.

Mowing Machine

A silent, flashless machine gun that used magnetic coils to jerk bullets through the barrel was designed by a Texas inventor. A working model could be powered by batteries or household current. In actual maneuvers, the gun could use a generator mounted on the truck that carried the weapon. The model fired 70 .44-caliber shots per minute with a muzzle velocity of 400 ft. per second. This was short of the 3000 ft. per second required for warfare. A full-scale version of the machine gun that could fire 600 rounds per minute was slated to be built. Since there was neither flash nor smoke, the gun could spray bullets at an enemy without being detected.



30 Years Ago: November 1970

Get The Picture

To say it was frustrating not to be able to receive those blacked-out games on your television was putting it mildly. To lure customers, bars and motels often used high-powered signal-grabbing equipment to pull in games from stations broadcasting outside the blackout area—usually a 50-mile radius around the home city. PM showed readers how to install a booster or rotor on their antennas and receive channels they had never been able to get before.

What About Bob?

Novice and expert skiers alike were discovering a new snow machine—the sitz ski, or skibob sit-down ski. The bob was a one-track steerable device with front and rear runners. It was about 7 ft. long and weighed about 25 pounds. The rider steered with handlebars, and wore a pair of short foot skis to create a stable tripod of feet and the device's center ski. The bob cost between $100 and $200. Aboard the skibob, even mediocre skiers could ride safely down slopes that might have been difficult (or suicidal) with standard equipment. Skibob wasn't dull, having established a downhill speed of 102 mph. It was estimated that bobs were available for rental at over 100 ski areas.

Introducing the redesigned Tacoma. With an available 190-horsepower engine and the highest ground clearance in its class.* Hang on.
TOYOTA
THINK YOU'RE TOUGH ENOUGH?
*Source: Manufacturers' published data, Tacoma 4x4 vs. competitive 4x4 compact trucks. www.toyota.com • 1-800-GO-TOYOTA ©2000 Toyota Motor Sales, U.S.A., Inc. Buckle Up! do it for those who [illegible]

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Technology Watch

Aviation • Computers • Energy
Environment • Medicine • Military
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Largest Radio Telescope Ever

A giant telescope will give astronomers their deepest view of space.

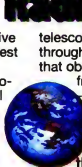
Called the Square Kilometer Array (SKA), it will be the world's largest radio telescope. SKA will detect faint energy emissions in the 0.15- to 20-gigahertz range. Its size will make it 100 times more sensitive than today's best radio telescopes. Like existing radio telescopes, SKA can see through the cosmic dust that obscures the view from conventional optical telescopes.

One design concept, shown here, would gather weak signals with a bank of steerable collection arrays and concentrate them on receivers held aloft by balloons. Computer controls would link individual arrays, so the system could look at 100 fields of view simultaneously.

"SKA's superior resolving power and image quality will be crucial to studying the formation and early history of stars, galaxies and quasars," says a spokesman for the 10-nation SKA Consortium.

A final telescope design and location will be selected in 2005. Construction could start in 2010.

Editor: Jim Wilson
Reporters: Carol Carder, Stefano Coledan, Mike Fillon, Leslie Hicks



November Highlights

Oshkosh Action—Builders fly their own at the annual experimental aircraft show.

■ **Stowing Steam**—U.S. Navy begins conversion to an all-electric fleet of fighting ships.

■ **California Dreaming**—Disney looks to its roots for inspiration for its latest theme park.

GYROCYCLE

ADAM M-309

GEN H-4

Our returning favorite was Gennai Yanagisawa's GEN H-4. This year, it sported an improved landing system. Wheels were replaced with "knuckle rollers" for better landing stability.

Oshkosh Air Show

Given the commercialization of what was once the proud hobby of building your own aircraft, we were especially happy to run into Carl Schneider of Fort Madison, Iowa, at AirVenture 2000. That's him at the left in his yellow and white high-wheeled Gyrocycle. It was the only originally designed rotorcraft at the annual gathering of experimental aircraft enthusiasts at Oshkosh, Wis., in July. His bird takes off and lands on three lightweight racing-bike tires. The extra height does more than make for an interesting-looking craft. It provides room for a 72-in. prop, which is powered by a 50-hp Hirth 2704 engine, through a 3.1:1 gearbox. This high wheel configuration makes for an exceptionally quiet and fast plane—he hit 100 mph on his way to the show. He could probably go 125 mph with spoke covers.

DISCOVERY 2000

SIX CHUTER

Adam Aircraft Industries showed off its six-place pressurized Adam M-309. Six Chuter brought its new Discovery 2000. And Garmin brought its clever NavTalk Pilot, a cellphone with GPS and a Jeppesen database. For full coverage visit www.popularmechanics.com/science.

NAVTALK PILOT

EUROLITE

EAGLE 150B

PHOTOS BY LESLIE HICKS (TOP AND BOTTOM), ADAM AIRCRAFT INDUSTRIES (BACKGROUND)

(More Technology Watch on page 20)

Whose G.I. Joe® Is It Anyway?

From your childhood on, in every backyard battle, G. I. Joe has always stood for America's protection. That heroism lives on as strong as you remember in a new and expanded collection of 12 inch figures including the G. I. Joe Trouble at Coyote Crossing™ Sheriff and Air Force Special Ops™. Just like the G. I. Joe of your youth, both are outfitted with authentically styled equipment and fitted with hand-sewn uniforms. Log onto www.GIJOE.com for an in-depth look and to view others in this great line. Now and forever, there's only one G. I. Joe.

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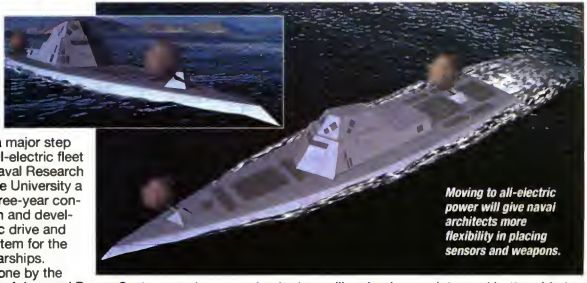
Navy Explores Electric Fleet



Moving to all-electric power will give naval architects more flexibility in placing sensors and weapons.

U.S. NAVY

The U.S. Navy took a major step toward creating an all-electric fleet when the Office of Naval Research awarded Florida State University a nearly $11 million, three-year contract to start research and development on an electric drive and integrated power system for the next generation of warships.

The work will be done by the university's Center for Advanced Power Systems and will take advantage of its expertise in superconductors and ultrapowerful magnets.

Electric ships will be light and fast. Replacing their hydraulics and compressed-air systems with motors and actuators will make them quieter and better able to sustain combat damage. Gas turbine generators could make nuclear reactors obsolete as well.

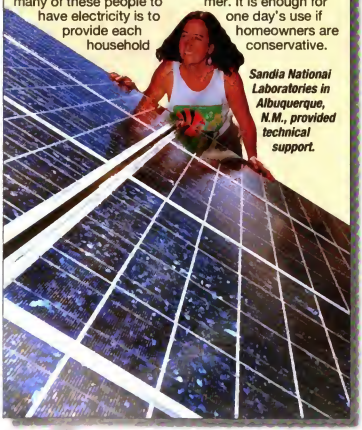
"It will change the character of our forces in a revolutionary way," says Navy Secretary Richard Danzig.

Navajos Plug Into The Sun

In the largest solar power initiative ever attempted in the United States, 200 homes on remote Navajo reservations in the Southwest will be equipped with photovoltaic systems.

"The only way for many of these people to have electricity is to provide each household with its own photovoltaic unit," says Jimmie Daniels, solar program manager for the Navajo Tribal Utility Authority. It decided to offer this alternative power source because it was cheaper than stringing wires.

Each system will furnish an average of about 3 kilowatt hours per day in winter, more in summer. It is enough for one day's use if homeowners are conservative.



Sandia National Laboratories in Albuquerque, N.M., provided technical support.

RANDY MONTOYA

Engineers Probe Nixon Tape

Using the technology that enables crash investigators to recover the faintest sounds from cockpit voice recorders, engineers at the National Institute of Standards and Technology hope to learn what is on the erased section of the famous Watergate tapes.

President Nixon taped White House conversations. But, an 18½-minute gap was found in a discussion with political aides recorded three days after a botched attempt to bug the headquarters of their Democratic opponents in the 1972 campaign. Check www.popularmechanics.com/science for updates.

Electric Thrusters Rev Up

Researchers at the Princeton Plasma Physics Laboratory hope to make plasma propulsion practical for use on small satellites. Satellites must from time to time fire small engines, or thrusters, to stay on their proper orbit.

The researchers believe the job can be done with a Hall thruster. In this device, the movement of positive and electrical charges through the system results in a net force opposite that of the ion flow.

A new cylindrical acceleration configuration (above) could be scaled down for small satellites, says a lab spokesman.

Physicists from Princeton and Israel (left) hope to make Hall thrusters practical for satellites and spacecraft.

PRINCETON PLASMA PHYSICS LABORATORY

(More Technology Watch on page 22)

Digimarc MediaBridge Index

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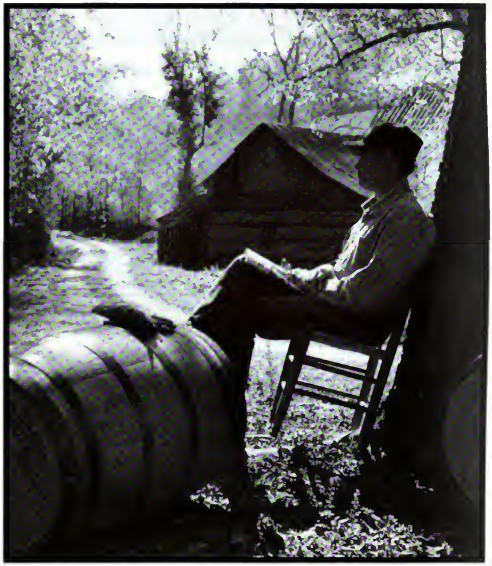

Why not settle back with a glass of Jack Daniel's sometime soon?

IN JACK DANIEL'S COUNTRY,

THE SLOW, LEISURELY LIFE HAS NEVER GIVEN WAY TO THE TENSION OF A HURRIED WORLD.

Here, far from the rush of the city, we still make Jack Daniel's the same way our forefathers did. Then, sit patiently by as the changing seasons bring it to proper maturity. Does our leisurely pace account for a smoother whiskey? Well, that's something we hope you'll discover first hand. A sip, we believe, will be more convincing than anything we could say or show.

JACK DANIEL'S OLD No 7 BRAND TENNESSEE WHISKEY

Your friends at Jack Daniel's remind you to drink responsibly.

Visit us at www.jackdaniels.com.

Tennessee Whiskey • 40-43% alcohol by volume (80-86 proof) • Distilled and Bottled by Jack Daniel Distillery, Lem Motlow, Proprietor, Route 1, Lynchburg (Pop. 361), Tennessee 37352 Placed in the National Register of Historic Places. ©2000

California Dreaming Inspires A New Disney Theme Park

California's alluring beauty and lifestyle has inspired a new Disneyland Resort theme park, Disney's California Adventure.

"Our goal is to immerse guests in compelling stories, evocative places and fantastic adventures that will bring the California dream to life," says Barry Braverman, executive producer of Walt Disney Imagineering, and creative director of the project.

The new theme park will attempt to capture the glamour of Hollywood, the beauty of Yosemite Valley and the "life is a beach" attitude that creates California's golden state of mind.

One of the studio-district attractions will take guests behind the scenes into a unique television studio, where they will become both the stars and the audience of a show.

Other attractions will let visitors fly hang gliders and sail rafts through California's scenic "natural" wonders.

Another area will pay tribute to California's beach culture by creating a nostalgic boardwalk experience.

"This is the largest expansion in our 44-year history," says Cynthia Harriss, president of Disneyland Resort. "It confirms our commitment to Walt's dream that Disneyland will never be complete as long as there is imagination left in the world."

The $1.4 billion addition will be located on 55 acres of the existing parking area, just south of the Disneyland main entrance in Anaheim, Calif. It will connect to Disneyland by an esplanade lined with restaurants, shops and entertainment related to the California Adventure theme.

The park is scheduled to open on Feb. 8, 2001.

DISNEY PHOTOS

The expansion includes a deluxe 750-room hotel called Disney's Grand Californian Hotel, to be located directly inside California Adventure.

WATERWORLD

Kid Tracking

At Denver's Water World park, parents can rent ParkWatches (below) to track their kids. A network of 14 hidden antennas listens for ID codes that are broadcast by tiny transmitters. Data is updated every 8 seconds. At special kiosks, parents can track their child's location on a map, with 10-ft. accuracy.

CAROL CARGER

(More Technology Watch on page 24)

SONY

Face it, your kids could've turned out better.

When it comes to printing a memory worthy of a frame, only the Sony UP-DP10 Home Photo Printer will do. Sony's printer produces photo-lab-quality pictures that you can't get from your average desktop printer. Don't get us wrong, your desktop printer is great for printing résumés and recipes. But for a long-lasting family shot, print it using the Sony UP-DP10. To find out more, visit us at www.sony.com/digitalphotography or call us at 1-888-531-7669.

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PLANET WATCH Recent events that changed our Earth.

NORTH POLE—For the first time in perhaps 50 million years, the ice has melted from the North Pole. The precise reason for the ice melting this summer is unknown, say scientists. And the speed with which it melted has caught them completely by surprise. In last month's Planet Watch, POPULAR MECHANICS reported that arctic expert Tore Furevik, of the University of Bergen in Norway, had predicted the arctic could be icefree by the summer of 2050. Actually, the ice will return this winter.

TAIWAN—Bilis, a Category 5 hurricane, set off massive landslides in mountainous regions in mid-August. Warnings had been issued early, and only one person died, in a mudslide. On weather radar the storm appeared bigger than Taiwan itself.

UNITED STATES—By midsummer, wildfires in a number of Western states had burned more than 5.1 million acres, an area larger than the state of Massachusetts. Montana was among the hardest hit, and the Army was brought in to relieve exhausted forest fighters.

INDIA—As many as 36 people drowned in the state of Madhya Pradesh in August when a flooded river swept away a bus carrying 100. Seasonal floods have left more than 2 million homeless.

JAPAN—It was a summer of earthquakes and explosions for residents near 2686-ft. Mount Oyama, which exploded on Aug. 18. Spewing smoke and rocks 26,000 ft. over the island of Miyakejima, it was the strongest blast from the volcano in 17 years. Japan's army had to be called in to clear volcanic ash off the roofs of homes. Two days later, a magnitude 5 quake on the seabed nearby, about 600 miles northwest of Tokyo, was felt throughout the neighboring Aomori and Iwate prefectures.

ENGLAND—British newspapers reported that it rained fish in the coastal town of Norfolk on Aug. 12. The storm, which dropped 2-in. fish on the town, is believed to have been an example of a rare weather phenomenon in which minitornadoes suck up and carry away debris in their path, depositing it miles away.

Civil War Submarine Raised

After 136 years, the Confederate submarine *H.L. Hunley* has been raised.

She sank with all hands in the night of Feb. 17, 1864, shortly after becoming the first submarine to destroy an enemy vessel.

Built from a 48-in.-dia. steam boiler and powered by hand cranks, the sub attached an explosive charge to the *Housatonic*, which was part of the Union's naval blockade of Charleston. Neither the *Hunley* nor her nine-man crew was seen again.

An expedition, financed by novelist Clive Cussler, found the *Hunley* beneath 30 ft. of water, 4 miles off Sullivans Island, S.C. Restoration will take several years.

See drawings and a history of the *Hunley* at www.popularmechanics.com/science.

After being raised, the Hunley was moved to a preservation tank.

Nanotubes Beat Friction

John Cumings, a graduate student at the University of California at Berkeley, has conquered friction, a big headache in tiny microelectromechanical devices. By peeling the tips off carbon nanotubes, he found he could create a virtually frictionless bearing. Nanotubes are so small that 10,000 would stretch across a human hair.

"These nanoscale bearings just slide as if there is no friction," he says.

UNIVERSITY OF CALIFORNIA AT BERKELEY

(More Technology Watch on page 28)

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York Peppermint Pattie. **Get the sensation.**

VDC

When you have 212 horses under the hood and the most advanced Subaru All-Wheel Driving System ever, it's hard not to feel confident. And that's the beauty of the new 6-cylinder Outback VDC. In addition to its new, more powerful engine, this Outback features Vehicle Dynamics Control. This revolutionary system uses a sophisticated series of sensors designed to detect impending loss of control, making

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automatic adjustments to help keep your car from drifting off track. Your enhanced level of power and control even extends into the leather-trimmed cabin, with an 8-way power driver's seat, a powerful McIntosh sound system and more. Visit us at **www.subaru.com**, call 1-800-WANT-AWD or stop in for a test-drive. Just don't let all that power and control go to your head.

OUTBACK VDC

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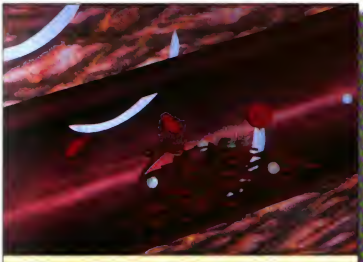
By Jove! It's A New Moon

A 17th moon has been discovered orbiting Jupiter. Less than 3 miles in diameter, it was found by astronomers from the University of Arizona in Tucson and the Minor Planet Center in Massachusetts.

When it was first sighted in 1974, astronomers thought it was an asteroid, and designated it UX18.

Observations made in the fall of 1999 led to new calculations. According to these, it is actually the smallest Jovian moon.

Until it is formally named, astronomers are calling it S/1999 J1.



Ultrasound Clot Buster

Sound could be the key to dissolving dangerous blood clots.

"The technique would dissolve the clot, not break it up into chunks," says Dr. Evan Unger, the principal developer of sonothrombolysis.

At low intensity, ultrasound is currently used to image heart blockages. Its most familiar application is, of course, in sonograms taken to see if a fetus is developing normally.

Targeting cells with a more powerful blast of ultrasound can disrupt cells and, at high levels, shatter kidney stones.

Unger detailed his findings at the recent Acoustical Society of America annual meeting, which was held in Atlanta.

He said that variations of the technology could be used to deliver drugs to specific disease sites, by causing tiny fatty capsules filled with medicine to, for example, burst near tumors.

MARK THEWPUTICS PHOTOS

Implant Grows With Leg

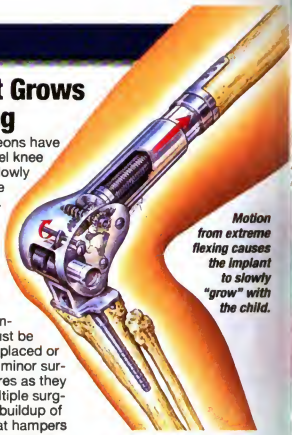
Austrian surgeons have created a novel knee implant that slowly extends as the patient grows.

Children who lose bone from the knee as the result of surgery to remove tumors now receive implants that must be periodically replaced or lengthened in minor surgical procedures as they grow. The multiple surgeries cause a buildup of scar tissue that hampers normal leg movement.

Dr. Rainer Kotz and his colleagues at the University of Vienna have developed an implant that slowly extends to keep pace with the child's natural growth.

To extend the implant, the knee is flexed through 100° in one movement. This causes a small rotation in a threaded rod, as shown here. After 18 of these repetitions the implant will be 1mm longer.

Currently the implant is available only in Europe.



Motion from extreme flexing causes the implant to slowly "grow" with the child.

SIMMONS DON

Protein On A Silicon Chip

Scientists at Purdue University in West Lafayette, Ind., have mated a silicon computer chip with protein to create the first protein "biochip."

"Chips containing thousands of proteins could be organized into a device about the size of a handheld computer that could quickly and cheaply detect specific microbes, disease cells and harmful or therapeutic chemicals," says professor Michael Ladisch, who coordinated the research team (above).

Scientists compare the binding of proteins to a key matching its lock. By attaching biological "keys" to computer chips, these biochips can detect specific microbes, disease cells and chemicals.

Proteins were attached to chips by using the electrical charges that naturally occur within proteins.

An early use will be in sensors to detect the *Listeria* monocytogenes in food. The pathogen causes food poisoning that kills about 500 people a year.

TERRY VICL

Cantilevered Relief For Sore Knees

Laying carpet to pay tuition at Arizona State University inspired Michael Worden to develop a better kneepad. "I studied 185 patents back to 1889 and there has never been a simple cantilever system," he tells PM. "The material to do this only recently became available." His cantilevered kneepad distributes weight along the shin instead of on the kneecap. He hopes his company, Worden Design (www.contactwith.com), can license the idea to a manufacturer.

WOM

(More Technology Watch on page 30)

Advertisement

P-touch®

Holiday REMINDERS

HANNUKAH
HANUKAH
CHANUKAH

No matter your race, religion or creed, the season of celebration, indigestion, and stress is upon us. From buying gifts and sending cards to just keeping up with the schedule of holiday parties, no time of year is more hectic. In order to help ease the path, Brother has come up with a list of holiday reminders that could be the difference between exploding and having a blast!

Hope this helps bring peace on earth and good will to all. Happy Holidays!

10. Be sure the addresses on all those packages you're mailing are tough, laminated Brother P-Touch® labels.
9. Use P-Touch labels to create your very own street, building and store signs when setting up your train set. Then when the holidays are over, you can pack your train sets away in boxes clearly marked with P-Touch labels.
8. Make Happy Chanukah labels and spell it any way you'd like.
7. Make sure your party guests know which bowl of eggnog is for the kids and which is for adults only.
6. As soon as the videotape comes out of the recorder, label it, so you won't tape over it.
5. Clearly mark leftovers. You wouldn't want to reach for the cranberry sauce and pull out beets.

4. Label those decorations (indoor, outdoor etc.) before you pack the boxes away.
3. Make a label restating your annual resolution to lose 10 pounds and stick it on the refrigerator.
2. Create beautiful place cards for your dinner guests using one of P-Touch's elegant fonts. Your guests will be impressed.
1. Buy the people you love most a Brother P-Touch Label Maker.

Brother P-Touch Electronic Labeling Systems can be purchased at most office equipment retailers. For more information, visit Brother's website at www.brother.com

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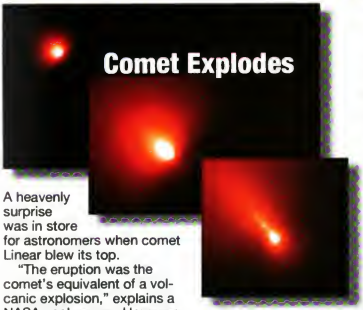
Comet Explodes



NASA

A heavenly surprise was in store for astronomers when comet Linear blew its top.

"The eruption was the comet's equivalent of a volcanic explosion," explains a NASA spokesman. However, the temperatures involved were cold, not hot—about 100° below zero in the icy regions of the comet's nucleus.

The explosion, which occurred on July 5 when Linear was 74 million miles from Earth, expelled a massive amount of dust.

"We lucked out completely," says astronomer Harold Weaver of Johns Hopkins University in Baltimore.

Comet Linear explodes on July 5 (top left), brightens on July 6, and reconsolidates on July 7.

Digital GPS Dejammer

The soft underbelly of GPS is its susceptibility to jamming. A relatively low-powered transmitter can overwhelm the weak timing signals broadcast by orbiting satellites. Current dejamming technology circuitry causes vehicle-mounted Global Positioning Systems to operate sluggishly, lessening their accuracy.

At the Farnborough International 2000 Air Show, Roke Manor Research (www.roke.co.uk) introduced an all-digital antenna control system called Adacu that reportedly nulls jamming faster than analog systems. It also pinpoints locations more accurately when there is no jamming.

ROKE MANOR RESEARCH

Production versions of Adacu will be one-tenth the size of the prototype shown at Farnborough.

Faster Crash Analysis

BAE SYSTEMS

A new way to replay the data stored on the black boxes recovered after airplane disasters will help investigators more quickly determine if a crash was an accident or sabotage.

The Icarus system developed by England's Defence Evaluation and Research Agency takes investigators inside the cockpit by showing them a simulated cockpit display. The system can be set up at the accident site. It also can be used as a training aid, to show pilots how their colleagues successfully dealt with unexpected flight emergencies.

Glass Building Simulator

A computer program could make a new European architectural style more popular in the United States.

Buildings with a lightweight double-skin facade have become a major architectural trend in France.

As shown here, glazed walls separate a ventilated airspace, with upper and lower vents. Properly designed, they save energy. Poorly executed, they are too hot in summer and too cold in winter.

To help architects get their designs right before they build, the French Center for Scientific Building Research came up with a Microsoft Excel spreadsheet to simulate airflow.

By reducing the size of heating and cooling plants, the program improves economics as well as aesthetics.

FRENCH TECHNICAL CULTURE PRESS OFFICE

U.S. Air Force Backs Off Space Combat

A new U.S. Air Force long-range planning document downplays the need for space-based weapons. It represents a major change from only five years ago when the Air Force had predicted the need for a host of weapons ranging from orbiting lasers to space planes.

According to the latest plan, titled "Global Vigilance, Reach and Power," the new go-slow approach is in part the result of limitations on weapons development as mandated by the 1972 Antiballistic Missile treaty.

The United States is currently trying to get Russia to reconsider the treaty, but this seems unlikely.

At its current pace, the first space weapon, an orbiting laser meant to shoot down ballistic missiles, would not be fielded for at least another 20 years. PM

Prestone antifreeze, now just $5.49 a gallon.

Considering that nearly half of all cars on the road lack proper antifreeze protection, perhaps it's time to visit your local AutoZone. That's where you'll get a great deal on Prestone and find all the parts and supplies you need to prepare your car's cooling system for the miles ahead. Everything from radiator hoses and fan belts to radiator caps and thermostats. All at a price that will save you money.

AutoZone®

The right part. The right price. And good advice.

Now get 10% OFF all radiator hoses and fan belts in stock with any antifreeze purchase.

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Technology

Talk Through The Portal

BY KIM KOMANDO

Easy information, via an 888 number, claims Audiopoint, an Internet voice portal.

Surfing the Internet

armed with keyboard and mouse isn't always possible. Suppose you're on the road and you need some information from the Internet. It could be a stock quote, weather report or even directions to that big meeting you're already late for. And suppose you don't have a Web-enabled phone from Sprint or Verizon. No problem.

You simply dial a toll-free number from any telephone and use voice commands to tell the system what information you need. In a matter of seconds, the information is supposedly pulled from the Internet and spoken back to you. We say "supposedly" because things don't always work as promised.

THE KOMANDO REPORT
COMPUTERS

There are a couple of items to keep in mind should you decide to use such a service. First of all, these voice portals offer only a limited selection of information, such as traffic, weather, stocks and sports scores. You can't search the entire Internet as you could by going to a Web site like **www.yahoo.com**.

Be aware, too, that nonvoice noises can foul things up fairly easily. For example, during our testing, one of these portals interrupted a weather report when it attempted to interpret a cough as a voice command. And finally, be prepared to hear commercials here and there. That's how the services make money. The good news is that in true Internet fashion, most of the voice portals are free. With all that said, here are a few voice portals that are blazing the trail.

AUDIOPOINT (www.audiopoint.net)
In terms of content, Audiopoint is not as robust as some of the other voice portals mentioned here. The available categories of information are: Financial, Horoscope, News, Sports News, Sports Scores, Stock Ticker, Team Reports, Traffic and Weather.

No registration is required. Anyone can call 888-38-AUDIO and use the service from anywhere in the world.

However, if you do decide to sign up, you can use a feature called myAudiopoint. By completing a myAudiopoint profile, you tell Audiopoint exactly what information you'd like to hear when you call in, as well as what order you'd like to hear it in. When you call, you simply state your 10-digit myAudiopoint number (typically your phone number, so it's easy to remember). The system then reads you the information that you have requested in your profile.

One thing that concerned us was that rather than synthesizing information from the Internet, some of the information, such as horoscopes and team reports, was in the form of recorded audio tracks. Because of that, some features may not get updated as often as you'd like. For example, we checked the sports report for the Phoenix Suns on Aug. 4 and heard a report dated Aug. 3. Not bad. However, when we checked the Arizona Cardinals the same day—just as the preseason was getting into full swing—the latest report was dated July 21. That may not be acceptable for a hardcore fan.

BEVOCAL (www.bevocal.com)
Although you can access BeVocal from any telephone, the service is targeted to mobile users. The list of information services includes: Driving Directions, Traffic, Flight Information, Weather and Stock Quotes.

BeVocal does ask that you register to use the service before dialing in at 800-4-BVOCAL. You aren't required to give your name during the registration process but you do need to provide your phone number, which we suppose you could make up if you were really concerned about it ending up in some telemarketing database.

Perhaps the most flexible feature is the driving directions. First of all, you can store your two most frequent starting or ending locations on the BeVocal Web site. That way, you can specify them when you call

(Please turn to page 34)

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for driving directions. Once you identify your starting and ending points, BeVocal pulls the driving directions from Mapquest. At that point, you have two options. You can have the directions spoken to you, or you can have them e-mailed to an address you've previously specified on the BeVocal Web site. If you need those directions before you get back to the office or home, you can connect to the BeVocal Web site with your WAP-enabled telephone and retrieve them.

QUACK (www.quack.com)

We found Quack to be the least impressive of these voice portals. The services include the typical listings of movies, restaurants, sports, stocks, traffic and weather.

Furthermore, the service seems somewhat slow, mainly because it takes the time to tell you what you've selected after you select it. We also experienced at least one accuracy

problem. While trying out the service in El Cajon, Calif., we were impressed that the theater listing feature knew through some caller ID scheme where we were calling from—Quack asked which theater in El Cajon we'd like to hear about. However, when we asked for listings for Regal Cinemas, we were given listings for Regal Cinemas in Oceanside, Calif., which is some 50 miles away. On the plus side, Quack does offer some nice on-the-phone handholding for first-time users.

TELLME (www.tellme.com)

For sheer volume of information, you can't beat Tellme. Its services include: Airlines, Blackjack, Horoscopes, Lottery, Movies, News, Phone Booth, Restaurants, Soap Operas, Sports, Stock Quotes, Taxi, Traffic and Weather.

Most compelling about Tellme is its integration of true phone services with its information services. For example, if you need a taxi, Tellme will find you a local taxi company—and then patch you through to that company so you can order your cab.

Likewise, once you find a restaurant you think you might like to try, you can listen to a Zagat review, if one is available, and then have your call routed to the restaurant's reservation line.

Need to make a quick long-distance call? The Phone Booth feature lets you do it for free. Just let Tellme know what phone number to call, and the service will foot the bill for the call. The only caveat: You're promptly disconnected after 2 minutes.

888TELSURF (www.telsurfnetworks.com)

At this writing, the only thing available at this site is general information about the upcoming service. And at this point, it's not clear when it will debut. However, based on the wide range of anticipated features, this is one worth following.

888TelSurf will offer a fairly unremarkable assortment of general information services, such as Sports, Stocks, News and Weather. However, 888TelSurf departs from other voice portals in its ability to provide you with personalized information. You can create and access both a personal calendar and address book, although it's not clear yet exactly how that information will get on the 888TelSurf site.

Even more amazing is the claim that you'll be able to check your Yahoo e-mail or send e-mail from any other POP3 account via your telephone.

If You Really Want to Pay...

If you're looking for more features than these free sites offer, you may want to consider a for-pay voice portal. One example is **InternetSpeech's** netECHO, at **www.internetspeech.com**. Amazingly, netECHO lets you surf the entire Web, allowing you to specify any URL you want. Once there, netECHO reads the contents of the page to you. The service also lets you check e-mail and even do some online shopping. But it doesn't come without a cost. The fee for netECHO is $29.95 per month.

And finally, if you don't like the idea of talking to a computer, consider iNetNow, at **www.inetnow.com**. With this service, you talk to a live person who's allegedly a certified expert Internet searcher. (I wonder if people can now major in Internet Searching in college.) You tell this "expert" what you're looking for, and he or she finds it. Prices range from $4.95 a month for five calls to $21.95 for unlimited calls.

You can subscribe to Kim's free weekly newsletter by sending an e-mail to subscribe@komando.com.

(Please turn to page 36)

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Digital Dame

BY TOBEY GRUMET

If you've ever thought it would be great to have a personal secretary at your beck and call, get ready to kick back in your ergonomic chair and prop your feet up on those gray cubicle walls. Motorola has got something—make that *someone*—for you.

Meet Mya, a digitally created woman designed to help you collect that much-needed data from your personal digital assistant—say, your mom's phone number—or retrieve information from the Internet.

Talk about virtually submissive. Mya is what Motorola calls a cyberassistant, and with her around, the only time you need to lift a finger is when you want to give Mya a call. She takes it from there. Need directions to a party? Want to have your e-mail read to you? Just ask Mya. If it's on the Web, she'll find it. The point is, all you do is dial an 800 number, talk and listen. No buttons, wires or switches to deal with. All you need is a phone and a PIN.

WIRELESS

Mya is your personal digital diva—ready to give you any info you need from the Internet.

A New Day Dawns

Television advertisements first shown during last year's Academy Awards presentation depicted Mya as a hip chick with spiky platinum-blond hair and a cocky smile (in the commercial, she was shown stepping out of a stretch limo, like so many other attendees at the Oscars). In reality, she's a disembodied voice attached to an animated image created by Los Angeles-based Digital Domain. The Mya service was created as an alternative to using wireless hardware and, if things go the way Motorola plans, she'll take over the Palm Pilot set.

Motorola doesn't want anyone to think about how Mya works—just sit back and let them worry about that complicated stuff. But we'll clue you in: Mya is a voice-enabled Web browser—a mobile platform that integrates both data and voice, eliminating the middleman of a computer.

The Mya service converts your questions into digital language, does a quick search of the Web, and comes back with the answers. If Mya needs more information, she'll ask you for it. You want to find a place to eat dinner, but how much do you want to spend? What part of town? Do you need reservations? These are just some things Mya may have to get specifics on. But remember, because you can only get information found on the Internet, Mya may not be able to do everything you need. If the restaurant you want isn't listed on the Web—you're out of luck.

Unlike those recordings you hear when you call your credit card company or bank for a balance or your latest transactions, Mya's is a real voice. In fact, it's the voice of Gabrielle Carteris, who played Andrea on the now defunct "Beverly Hills 90210." To me, Motorola's choice smacks severely of male chauvinism. But, the company talked to people all over the world and their research showed otherwise. Julie Roth, director of marketing for Motorola Internet and Connectivity Solutions Division, says, "We wanted to humanize this kind of digital voice technology and the expectations we got from our research was that it would be female." Okay, but I'd still rather have Sean Connery's voice with the digital image of a tall, dark handsome man in a three-piece suit. To each their own.

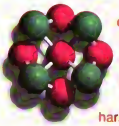
Roth foresees Mya eventually being able to switch voices and speak different languages (right now she can speak only English, like most of us pitiful Americans).

Motorola hopes to have the service ready by December. Because the pricing will vary, depending on which mobile carriers decide to pick it up, there are no set prices yet. However, Motorola expects Mya to be competitive with other data services that are being offered for approximately $10 per month. PM

THINK OF IT AS ROLAIDS® FOR YOUR ENGINE.

In many ways, your engine is a lot like your stomach. It "digests" a mixture of air and fuel and turns it into energy. Unfortunately, this digestion process (also known as combustion) can often lead to acids in your engine. Left unchecked, these acids can lead to rust and even corrosion on vital engine parts, such as cylinders, bearings and hydraulic valve lifters. (Not surprisingly, 80% of engine wear occurs at startup, when the acids in your engine are at their very worst.)

Syntec's unique molecular components bond to engine parts.



Syntec actively seeks out and neutralizes corrosive acids in your engine.

Castrol Syntec is just what the doctor ordered. Its unique synthetic formula contains powerful detergents that actively seek out and neutralize acid in your oil. As a second line of defense, Syntec forms a protective barrier that helps prevent any remaining acids from reaching engine surfaces.

The result is that acids in your engine are rendered virtually harmless.

Which just goes to prove that when it comes to protecting your engine, *Syntec* is the best way to spell relief.

Castrol Syntec can be used in all makes of cars, new and old, including vehicles in which conventional oil was previously used.

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Outdoors

Have A Stroke

BY CLIFF GROMER

Want to swim better?

Go to the experts—the fish. While we crawled out of the water eons ago (if you subscribe to the theory of evolution), fish just kept on, well, swimming. No wonder they've become so good at it.

Equipment Bodysuit is an example of better strokes through chemistry.

Adidas went back to studying fish, along with Olympian swimmers and aquatic mammals, to improve on its Equipment Bodysuit and give world-class athletes and weekend swimmers alike a serious performance-enhancing swim aid. The Bodysuit follows Adidas's "energy maintenance" approach to sports equipment design, which helps an athlete perform at his maximum potential.

Engineers and scientists at Adidas isolated four main needs and concerns of the swimmer, Olympic or otherwise: proprioception, temperature control, drag and muscle oscillation. Proprioception, that is, muscle awareness, is the most important element that a suit lends to our bodies. The suit presses against the skin in such a way as to give an athlete the feeling of being stronger and more in control. The suit creates compression that allows the nervous system to provide better feedback on where the body is positioned. Soccer players, for example, create a proprioceptive effect when they tape their feet. The close-fitting sleeves worn by baseball players and the tight suits of ballet dancers perform likewise.

SWIMMING

Tests conducted with high-speed cameras monitored the movements and body positions of swimmers. Analysis of the data divided swimming into four phases: a dive phase, an acceleration phase, a high-speed phase and a turn phase. Within each phase the different positions of the head, shoulders, knees, elbows, feet and ankles were taken into account and each phase was further divided into 20 smaller phases.

Analyzing the positions needed in each phase, a mathematical model was created to represent 100 percent perfection in swimming. This model benchmarks a particular swimmer's body positioning against perfection. The tests concluded that an athlete is better able to position his body in the Equipment Bodysuit than in a regular competition suit. The result is a swimmer who moves more efficiently.

Temperature control is extremely important, as well. It is known that an athlete has more power with a core temperature of 38° C (a slight fever) versus the normal body temperature of 37.5° C. Endurance is unaffected, but power of velocity is increased because the higher temperature causes chemical reactions in muscle tissue to occur faster and, as a result, the contraction is faster. Of greater concern to athletes and Adidas is keeping temperature from becoming more of a hindrance than an asset.

A Lycra bodysuit retains some of the heat generated by the body, but at the same time the body's ability to control temperature is much better in water, thanks to a greater temperature conductivity and a lower ambient temperature. Professor Dave Smith at Calgary University helped Adidas find a comfortable balance for athletes. A transmitter pill measuring core temperature was given to swimmers so they could be monitored while swimming. The result: No one overheated in the full Bodysuit.

Drag was handled easily with the help of fabrics developed by DuPont. The finished product has lower surface drag than that of skin. It is important to remember that because humans propel through the water in a turbulent fashion (compared to fish) the reduced friction factor is small when compared with other variables. Increased friction would have been much more of a problem.

Finally, muscle oscillation is a problem in many sports, most noticeably in running. When viewed through a high-speed camera, a runner's leg muscles look like Jell-O with random movement everywhere. Cycling, interestingly enough, is not plagued by muscle oscillation because the motion keeps fine

muscles tense, limiting oscillation. Controlling oscillation is important for reducing the level of fatigue and gaining higher endurance. Is there much muscle oscillation in swimming? The high-speed camera test says yes, and it is most apparent when watching a freestyle swimmer's legs and thighs when he kicks or after a turn. Equipment Bodysuit's compression not only serves to increase accuracy, but to limit muscle oscillation by compressing the muscle.

How well does the suit work? Ian Thorpe, the wunderkind of swimming, has broken 10 world records in the suit over the last 12 or so months. In the Australian trials, he shattered three world records. How much of it is the suit and how much of it is him? The man was born built for swimming and he maintains a regimen of excellent training and a disciplined diet. Thorpe's natural ability is only maximized in the suit. Smith, of Calgary University, tested athletes' performance with the Equipment Bodysuit, a pair of swim trunks and another suit. In the Bodysuit, swimmers swam the same distance in fewer strokes. Tests also showed that the swimmers' heart rates were lower when using the Adidas suit than in the competing brand.

Dream Paddles, a new training aid from High Tech Sport in France, are helping to produce more efficient swim strokes in a different way. The left-handed paddle features a built-in computer with an LCD screen that gives you information on how many calories you're burning, the average water pull-through of each stroke, elapsed time and the number of strokes. The information is organized by lap and can be viewed as the total for time in the pool, as well.

PHOTO BY J.P. DURETZ

Dream Paddles give you feedback on your swimming style.

The paddle's "brain" is a force-sensing resistor. Nicknamed "the electronic gas pedal," the sensor's resistance drops as you apply greater force to it. Using information from the paddle, you can see how strong your stroke is by monitoring how much water pull-through occurs. The sensor also measures how many stroke cycles you take per lap. Greater water pull-through means a more efficient stroke. Fewer stroke cycles in a lap means you are swimming more efficiently—using your feet, arms, legs and hands to cover more distance with less energy expenditure. An added benefit is the resistance of the paddles in water, which strengthens muscles. Expect to see Dream Paddles in the near future at dive stores and swim shops in the United States.

But remember: If you buy this gear and find yourself feeling smug about your swimming prowess, what with your high-tech Equipment Bodysuit and your Dream Paddle-honed swimming style, know that on any given day you can be completely humiliated by any largemouth bass. PM

Jon Gromer contributed to this article.

Automotive

Reports From Around The World

New look, new engine and new suspension make for all-new Explorers and Mountaineers.

2002 Ford Explorer/ Mercury Mountaineer

Once again, Ford finds itself in the enviable but tricky position of having to update a proven winner. Like the F-Series pickup truck, Ford's Explorer is—and has been—the best-selling sport utility vehicle. For 2002, Ford is determined to continue its leadership position by offering important changes in its newest Explorer and its kissing cousin, the Mercury Mountaineer. Wheels are set out a meaningful 2½ in. to offer a smaller turning circle—almost 2 ft.—that will make those shopping center U-turns easier. The wheelbase is 2 in. longer and that should translate into a smoother ride, but the bumper-to-bumper length is a tad shorter. Still, ground clearance has been increased 1 in., and the vehicle will have the same or better angles of approach and departure as the older Explorer. Inside, the added dimensions contain a number of new convenience and safety features, including optional curtain-style side-impact airbags and adjustable brake and accelerator pedals. A two-person third row—optional on the Explorer, standard on the Mountaineer—folds almost flat into the floor when not needed. The instrument panel has been completely redesigned, with the radio, heater and a/c controls conveniently set closer to the driver. Among the functional improvements are the 2-in.-lower rocker panels for easier entry and exit, a new (for this vehicle) V8 engine and the long-rumored independent rear suspension. The new engine offered is Ford's 240-hp OHC 4.6-liter, which replaces the 5.0-liter pushrod V8. The standard engine is a 210-hp 4.0-liter V6. A five-speed manual transmission is standard with the V6 engine. A five-speed automatic transmission is optional on the V6 but standard with the V8 engine. Two-wheel drive is also standard, 4wd is optional, and the Mountaineer alone offers an awd option. Between the wheels and the body you'll find coil springs in front (in place of the former model's torsion bars), and in back the solid axle is gone, replaced by an independent setup. The clever mounting of the rear differential gearset is the key to providing the space for the foldaway third seat and the amazingly lowered—by 7 in.—rear floor. The vehicle's crash compatibility with passenger cars has been improved by a lower front faceplate that ties the frame rails together. Ford also claims an increase of 30 percent in the effective brightness of its low-beam headlights, thanks to new round reflectors. *—Jim Dunne*

NEW CARS

2001 Kia Rio

Get down. Get funky. Thanks to Kia, the '70s are back. Well, in terms of new-car prices, anyway. For $8595, you can buy yourself a brand-new 2001 Kia Rio. It won't have a CD changer, a navigation system or heated seats. Heck, you can't even get power windows. But dig this, it's cheap, it's new and it comes with a 10-year/100,000-mile powertrain warranty. Groovy, man. We previewed the Rio back in August, but now we've had a chance to spend some time in its cloth-covered seats, and we can tell you that this little sedan won't do the hustle at the dragstrip. Hey, cars from the '70s aren't remembered for their performance. The Rio is powered by a 96-hp 1.5-liter DOHC Four. It comes with a five-speed manual. But,

(Please turn to page 42)

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if you're willing to raise the car's price by about 10 percent, $875, you can specify an optional four-speed automatic. The roads of the 21st century are full of SUVs, and the five-speed Rio has the oomph to merge onto a freeway overrun by them. There's more than enough power to go pick up your leisure suit from the dry cleaners. Unfortunately, that automatic cripples more than the car's base price—it cripples the car's performance.

Built on a refined version of the old Ford Aspire chassis, the Rio rides on an independent MacPherson-strut front suspension and a simple torsion-beam rear axle. The ride is tuned soft, but it's still fun to toss around in the corners, thanks to its lithe 2242-pound curb weight. Push the car, though, and the result is body roll combined with protesting squeals from the tiny 13-in. tires. The Rio relies on a conventional front disc/rear drum brake setup. And they work fine. But we think opting for ABS is $400 well spent. The rack-and-pinion steering is manual on most Rios and does an adequate job of relaying road feel to the driver.

The Rio is available only as a four-door sedan. It's tight quarters for four full-size adults. But rear-seat legroom, at 32.7 in., is better than a Nissan Crew Cab and there's enough footroom for your new platform shoes. Fit and finish inside is good, too—better than you'd think for the price. Options are few but include air conditioning, power steering, automatic transmission, 14-in. alloy wheels and even a rear spoiler for that extra downforce needed to keep the car stable when you next tackle Talladega.

—Ben Stewart

DETROIT SPY REPORT

BY JIM DUNNE

2002 Jeep Cherokee

Here's a Jeep Cherokee prototype so new that the camouflage is almost wrinklefree. The 2002 model offers a number of changes that stand out, even with the extensive covering seen here on the grille and fenders. Close inspection of the front end reveals the trademark slotted grille, but with bars set at an angle instead of upright. A hint of round headlights appears in those rectangular openings that flank the grille. Sporty, six-spoke wheels are fresh. Overall, the body shape is much more rounded and the side glass has a more aggressive curvature. At the rear, a full-size spare tire hangs on the tailgate and extends up into the rear glass and down over the bumper. Note the inset license plate nook and the tailgate-mounted rear wiper. Those heavy pads over the wheel arches are designed to hide fender flares, and there's heavy cladding on the lower door sections that's also hidden.

2003 Cadillac Catera CTS

While Cadillac struggles to get in lock step with the rest of the auto industry by offering a rear-wheel-drive, top-of-the-line luxury model, it has a new version of its entry luxury model, Catera. This prototype was caught testing in suburban Detroit and, despite the masking, has the current bold grille that Caddy's been showing on concepts like Imaj and Evoq. Due in the States as a 2003 model, the Catera will continue to sell below the established luxury-car level, even in this CTS trim level.

2004 Ford Fairlane

In a secret project that Ford has kept tight wraps on for the past two years, a new rear-wheel-drive car is being developed that will fit into the full-size sedan market just above the Taurus but below the evergreen Crown Victoria. And the car is going to carry a name rich in Ford heritage: Fairlane. The hush-hush Fairlane project will produce a new vehicle by the model year 2004. Look for this car to offer both V6 and V8 engine power with a special version of the V8 aimed straight at the 60,000-unit-sales-a-year police cruiser market.

2002 Pontiac Grand Am

Our camera caught just a smidgen of the 2002 Pontiac Grand Am, but that's enough to show the direction Pontiac is taking with its styling for the future. Overall, the new car's front end looks like a logical progression from the design of the current Pontiac Bonneville, with a front lip on the hood that protrudes past the grille opening like an overbite. The grille itself has a winged outline, with the now standard vertical Pontiac badge mounted on a vertical bar in the center.

DETROIT SPY PHOTOS BY JIM DUNNE

(Please turn to page 44)

WHY IS THIS CONSIDERED THE MOST ADVANCED WIPER SYSTEM EVER? YOU'LL SEE.

Bosch Micro Edge Excel is in a class by itself. Its Ⓐ fully enclosed metal tension spring provides even pressure across the entire blade for superior moisture removal. Our exclusive dual rubber technology features Ⓑ a rubber formulation for superior flip-over, reduced chatter and quieter operation, and Ⓒ a wiping edge rubber for better wipe quality and wear resistance. Our new, pre-installed universal adapter makes installation simple. The Bosch Micro Edge Excel will make things a lot clearer. Call 1-888-TOP-BLADE for a retailer or visit us at www.boschusa.com.

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ASIA SPY REPORT

BY BEN STEWART

2002 Isuzu Axiom

It's heavily camouflaged here, but this is Isuzu's next SUV, the Axiom. First shown at last year's New York auto show as the ZXS concept, the Axiom copies that vehicle's bold, futuristic front styling verbatim. Like all Isuzus, the Axiom is a real body-on-frame, truck-based SUV and uses a combination of Trooper and Rodeo chassis bits. Axiom also gets the Trooper's 4wd system with a new pushbutton low range. Power is from a pumped-up version of the Trooper's 3.5-liter Six, said to develop 230 hp, enough for a 5000-pound towing capacity. Dimensionally, expect the Axiom to be Trooper-size—but sitting lower and wider—and to use Isuzu's Intelligent Suspension Control "smart shocks" for crisper handling, along with street-biased 235/65R17 tires. Isuzu will build 24,000 Axioms for U.S. consumption at its Lafayette, Ind., plant where it builds the Rodeo and the Amigo (now called the Rodeo Sport). Pricing will be around $35,000 when it rolls into dealerships in spring or summer 2001 as a 2002 model.

PHOTO BY HANS LEHMANN/ROCKS IMAGE

2002 Subaru Impreza Turbo

Finally, Subaru is meeting the demand for more power for its products here in the United States. Initially held up by emissions certification, this completely redesigned Impreza with an optional 218-hp turbocharged boxer four-cylinder will be available as a 2002. To harness that extra power, a new six-speed manual is likely to be in the works. Look for a continuously variable automatic transmission with flexible logic control in a year or two. The new Impreza is wider and longer than the outgoing model. The round headlights differ from those on current Imprezas, but States-bound cars may get a more traditional angular light design. The car is based on a shortened version of Subaru's new Legacy platform and may feature a multilink rear suspension co-developed by Porsche in place of the current strut setup. The new Impreza will debut this fall at the British International Motor Show. This photo is likely of the more radical 280-hp WRX version that will debut later, but it probably will not come to our shores.

PHOTO BY BRENDA PRIDDY AND CO

2002 Kia Sedona

Sold in other parts of the world as the Kia Carnival minivan, the U.S. version will arrive as a 2002 model carrying the Sedona name. From the outside, the biggest change from the Carnival is the new nose with a taller hood and grille. This was probably necessary to house its Hyundai/Mitsubishi 200-hp 3.5-liter. In Korea, the largest gasoline engine available is a 2.5-liter V6. The Sedona will be an eight-passenger minivan with sliding doors on both sides. Dimensionally, it should be slightly smaller than the Honda Odyssey and sit on a 4-in.-shorter wheelbase. The suspension has MacPherson struts up front and a beam axle with coil springs for rear-end duty.

PHOTO BY HANS LEHMANN/ROCKS IMAGE

2001 Suzuki XL7

The Grand Vitara will no longer be Suzuki's grandest trucklet. For 2001, Suzuki gets this extended-wheelbase version called the XL7. The XL7's wheelbase is a foot longer than the Vitara, putting it in the neighborhood of 110 in. That's enough chassis length to offer a third row of seats and room for seven passengers. This will be Suzuki's most upscale SUV and will feature a larger displacement version of the Grand Vitara's 155-hp 2.5-liter V6. Buyers also will be treated to leather seats.

PHOTO BY BRENDA PRIDDY AND CO

2002 Acura Integra

The current Acura Integra is showing its age after being on the market since '94. Here is a computer-enhanced look at the fourth-generation Integra, due as a 2002 model. Gone are the dual round headlights, replaced with lights more in line with the rest of the Acura family. Sources say the new car remains front drive and stays about the same size. However, you can expect it to become more sophisticated and lose the Integra name in favor of alphanumerics, like all Acuras. A new generation of high-revving VTEC four-cylinder engines is expected to be larger than 2.0 liters and to have power ratings from 200 to 220 hp. PM

PHOTO BY HANS LEHMANN/ROCKS IMAGE

*GMAC must approve lease. Comparison based on a Bank Rate Monitor survey of the five largest banks in the 25 largest metropolitan areas, comparing the payments on typical $20,000 and $40,000 bank loans versus the average payments on SmartLease contracts of similar length for a $20,000 and $40,000 vehicle. Payment difference may vary based on individual creditworthiness. Of course, with a purchase, the buyer owns the vehicle. At the end of a SmartLease contract, the lessee can return the vehicle or exercise their purchase option. Bank Rate Monitor and National Index are marks owned by Bankrate.com℠, a division of Ilif.com, Inc., N. Palm Beach, FL 33408. GMAC is a registered service mark of the General Motors Acceptance Corporation. ©2000 GMAC. All Rights Reserved.

Science

The Odds Against E.T.

BY JIM WILSON

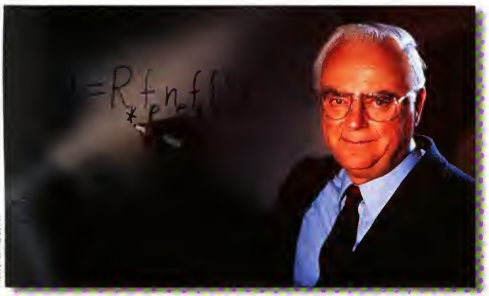

PHOTO BY SETH SHOSTAK

Drake and his E.T. predicting equation.

When my 8-year-old nephew Connor first started asking questions about the night sky, his dad correctly told him that there were nine planets. This year, in third grade, Connor will learn that there are at least 50 more planets. We say at least 50 because that was the official number at the close of the latest meeting of the International Astronomical Union (IAU). During the past few years, astronomers have been aggressively searching the skies for signs of "extrasolars," planets beyond our local solar system. When they get together at IAU meetings, such as the one held in Manchester, England, in August, they compare notes. "We're now at a stage where we are finding planets faster than we can investigate them and write up the results," says Geoffrey Marcy. His team, from the University of California at Berkeley, added three new planets to the fast-growing list. Including our sun, we know of 44 stars that have at least one planet.

ASTRONOMY

For backyard stargazers, the most exciting extrasolar discovery was recently made by the team from the University of Texas's McDonald Observatory. They detected a planet around Epsilon Eridani, the fifth-brightest star in the constellation Eridanus. Just a bit smaller and cooler than our sun, the star is 10.5 light-years away from Earth—close enough to see with the naked eye. "You can go outside at night and point at it and say that star there has a planet around it," says McDonald's William Cochran. You won't, however, be able to call the planet by name. The discovery of extrasolars is so recent and rapid a development, a naming system has yet to be worked out.

What professional astronomers find most interesting about this roughly Jupiter-size planet isn't its distance from Earth, but its distance from Epsilon Eridani—about 297 million miles. "The exciting thing about this discovery is that having a large planet orbiting fairly far out from Epsilon Eridani means there could be room for Earth-like planets in a reasonably stable orbit closer to the star," says Cochran. Earth, you will recall, is about 93 million miles from its local star, the sun.

Finding Little Planets

A new technique may make it possible to find even more of these smaller planets. Extrasolars are too far away to be detected by optical telescopes, so researchers look for subtle changes that orbiting planets induce in the appearance of their parent star. It is exacting work that requires instruments that are of superior quality, even by the standards of professional observatories.

This summer, NASA announced that it may also be possible to find hidden planets by "reading" the patterns imprinted in dust discs around nearby stars. Gravitational influences of newborn planets weave patterns in the dust discs from which they are forming, say NASA researchers. The type of pattern reflects the planet's mass and orbital characteristics. "If confirmed, the new disc analysis method promises to allow the discovery of extrasolar planets that are undetectable with current methods," says a spokesman for NASA.

In 2004, Neville J. Woolf, an astronomer at the University of Arizona's Steward Observatory in Tucson, will begin using the Large Binocular Telescope, with its twin 8.4-meter mirrors now being built on Mount Graham, also near Tucson, to image the dust around stars.

"There is a good chance of finding Earth-like planets and even of finding life on these planets if it's there. The main reason for thinking that life is not difficult to get started on an Earthlike planet is that on Earth, life began so soon after the period of catastrophic collisions 4 billion years ago," Woolf says. "It is hard to imagine that there was any really difficult process on the way. I think that there was continuity from chemicals cyclically

(Please turn to page 48)

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combining and breaking up in volcanically warmed places of early Earth, to the formation of self-replicating chemicals, to the development of life and ourselves."

The Drake Equation

With the discovery of each new extrasolar, the odds of finding intelligent life elsewhere in the galaxy increase. It is part of a calculation first detailed in 1961 by astronomer Frank Drake, the founder of the Search for Extraterrestrial Intelligence initiative. Shown in the photo on the previous page, the Drake Equation examines seven factors that would determine the number of "communicative societies"—that is, the number of civilizations able and willing to talk to earthlings.

The first factor in the equation is the rate of star formation in the galaxy. The more new stars that form, the more chances there are that planets will also form. This is believed to be a small number, between two and 20 new stars a year.

The next factor is the number of stars that can support planets. As announcements at recent IAU meetings indicate, the number of extrasolars literally grows larger each passing week.

Next comes an estimate of the fraction of extrasolar planets that are habitable. Most of the extrasolars found thus far are Jupiter-like gas giants. It may be that small solid planets are truly rare. Others theorize that our instruments are too crude to see Earth- and Mars-size worlds that are many light-years away. For the purposes of the Drake Equation, habitable means temperatures at which water exists as a liquid. Five years ago, only one body in our own solar system fit this description: Earth. Since then, images returned by spacecraft sent to examine Mars and the Jovian moon Europa have expanded this list to three.

In the past, the toughest part of the Drake Equation was thought to be estimating the fraction of planets on which life originates. Within the past five years, research outside the field of astronomy has provided an important hint. Chemists specializing in the field of nanotechnology have found that carbon spontaneously forms sphere- and tubelike structures. If, as a growing number of chemists now suspect, "spontaneous self-assembly" is a natural precursor to life, the number of planets on which life could emerge may be very large indeed.

The next factor in the Drake Equation is likely to remain an unknown until we actually make contact with an alien race. Until then, we can only guess how many planets support intelligent life.

Next, there is the question of whether this intelligent life has the technology and the willingness to talk to us.

Finally, there is the most humbling factor of all—longevity. The crater-scarred surface of our moon reminds us how easy it is to get whacked. By the time we get around to picking up E.T.'s call, his world could have been reduced to stardust. You don't have to be a mathematician to see what the recent announcement from the IAU meeting means for the prospects of encountering alien life. The more extrasolars astronomers find, the more likely E.T. will finally call home—our home planet, that is. PM

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Great Stuff

From home improvement to outdoors, automotive to electronics, here's the newest gear you'll want to own.

EDITED BY CLIFF GROMER

Send A Signal

When you need help in a boating, camping or other outdoor situation, grab Skyblazer's new compact XLT 1 kit. It's easy to pack along and it could be a lifesaver. The 5 × 4 × 2-in. pack attaches to your vest or belt and contains three red aerial flares, an emergency whistle with lanyard and an international distress flag with grommets and ties. It's also waterproof and it floats. The flares reach an altitude of up to 500 ft. and burn for 8½ seconds. They are visible for up to 22 miles and outperform most 12-ga. flares. The XLT 1 signal kit costs $29.75 from Skyblazer Inc., 4275 N. Palm St., Fullerton, CA 92835-1045; 714-447-5409; www.skyblazer.com.

Socket's Red Glare

Forget about working in the dark. Team Mechanix Lighted Socket Drivers have a bright built-in light that shines through the center of the socket so you can see fasteners and spark plugs in low-light situations. The socket driver works like a conventional socket extension bar by extending the reach of a ratchet. The tool's slim design makes it ideal for working in hard-to-reach areas. Available styles include a ⅜-in. drive with 3-in.- and 6-in.-long drivers and a ½-in. drive with 3-in. driver. Prices range from $7.99 to $15.99 at national auto parts chains. Contact Alltrade Automotive at 800-368-6653; www.alltradetools.com.

Editor's *Feature Product*

Make The Switch

Now control your indoor and outdoor lights by remote control. No more crawling on the floor to unplug Christmas tree lights. Switch on your outdoor lights from inside. The Combo Pack Wireless Remote Control Switch can be used with both indoor and outdoor lights with a dual function remote control. Signals pass through walls and doors and have a range of up to 35 ft. The unit can handle up to 960 watts. It costs $34.95 plus $5.95 shipping and handling.

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Think Big

A beefed-up single-stage snowthrower? "Big deal," you might say. But we think it is, because improving the capacity of a single-stage machine without sacrificing its nimbleness is an idea worth investigating. This snowthrower has a 7-hp, two-cycle engine, a 24-in. clearing width and a three-paddle drum auger, instead of the usual two. The extra paddle on the auger, combined with improved paddle geometry, is coupled with a handle-operated, weight-shifting mechanism. This causes the machine to shift its weight forward onto the auger, helping the machine to pull itself through the snow. The intent here is to eliminate the need to shove the machine around as you would a typical single-stage design. The snowthrower retails for about $700 to $800 at Toro dealers. Contact the company at 8111 Lyndale Ave. S., Bloomington, MN 55420; 800-595-6841.

Greasy Side Up

A professional quality lift at an affordable price. That's the Bend-Pak model SP-7—a drive-over-style, 7000-pound-capacity lift with a frame size less than 7 sq. ft. The SP-7 requires no special foundation and installation is simple. With a lowered height of just 5 in., it is perfect for servicing full-size vehicles, light trucks and even low-profile imports. Vehicles are raised a full 70 in. in less than 1 minute. The SP-7 features pneumatic multiposition safety locks, mechanical equalization to keep platforms level, a dependable hydraulic design, a padded cross-beam and unique diamond-plate approach ramps that can be locked into place for additional platform length. The SP-7 costs $3950, including shipping. Other models are available starting at $1250 from Garage Equipment Supply, 2353 E. Main St., Ventura, CA 93003; 800-261-7729; www.gesforless.com.

Spread It On

Wireless phone technology keeps getting better and better. With the Toshiba SG1800 2.4-GHz Spread Spectrum phone, you get excellent reception with less interference—even when the handset is far away from the base unit. Features include a Caller ID that can list 50 names and numbers, Caller ID on Call Waiting, 30-channel autoscanning, a headset jack, seven-day standby battery life, a page/handset locator and Digital Call Protect privacy scanning. Retails for $169.99. Contact Toshiba, 82 Totowa Rd., Wayne, NJ 07470; 973-628-8000.

Point The Way

Get more than just the right way to go. Get temperature and altitude too. The V5000TA series Multi-Sensor Vehicle Compass provides directional readouts, indoor and outdoor temperatures, an automatic trip timer, digital clock, black-ice warnings, altimeter readings and trip logs—all for $129.95. The compass comes with an adjustable mounting bracket that rotates 180° and can be attached with heavy-duty suction cups. The unit operates on two AAA batteries or an optional 12-volt power cord. The compass is available from California Car Cover Co., 9525 DeSoto Ave., Chatsworth, CA 91311; 800-423-5525.

Padding Around

If you love your Palm organizer, here's another innovative way to use it. Seiko's SmartPad allows you to instantly transfer handwritten notes and drawings from paper to the Palm through an infrared port. Small and easy to carry around, the SmartPad looks like a notepad and is powered by three AAA batteries. It is compatible with Palm III series or later models and must be used with an IBM-compatible Pentium or faster-running computer using Windows 95 or later. A SmartPen is provided along with five ink-refill cartridges. Retails for $199. Contact Seiko, 1130 Ringwood Ct., San Jose, CA 95131; 800-757-1011.

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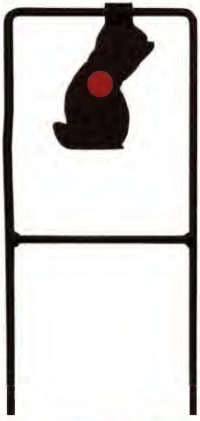

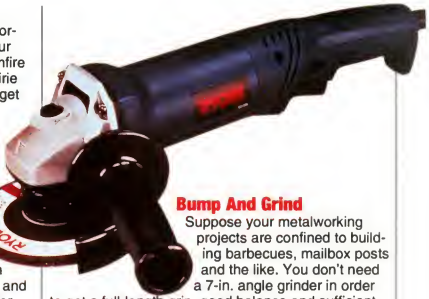

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(More Great Stuff on page 56)

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(More Great Stuff on page 59)

MEET AAGE KRISTIANSEN: This Swedish scientist, trained at the renowned Gothenburg Technical Institute, joined Tempur-Pedic in 1989 at a critical time—when building the first weightless sleep system (with promising but unperfected aerospace materials) seemed impossible. Aage discovered the formula that saved the company's Tempur® project from abandonment. His colleagues were euphoric! He was hailed as the "father" of the Tempur-Pedic revolution, which has fundamentally changed the way people sleep. Aage now lives in Sarö, a small coastal village 20 kilometers south of Gothenburg.

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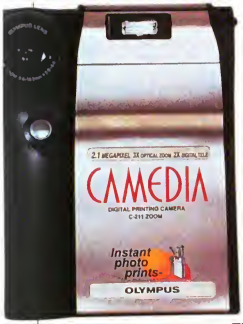

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AMERICA'S NUCLEAR FLYING SAUCER

A trail of secret documents reveals the startling truth about the U.S. Air Force's flying disc aircraft.

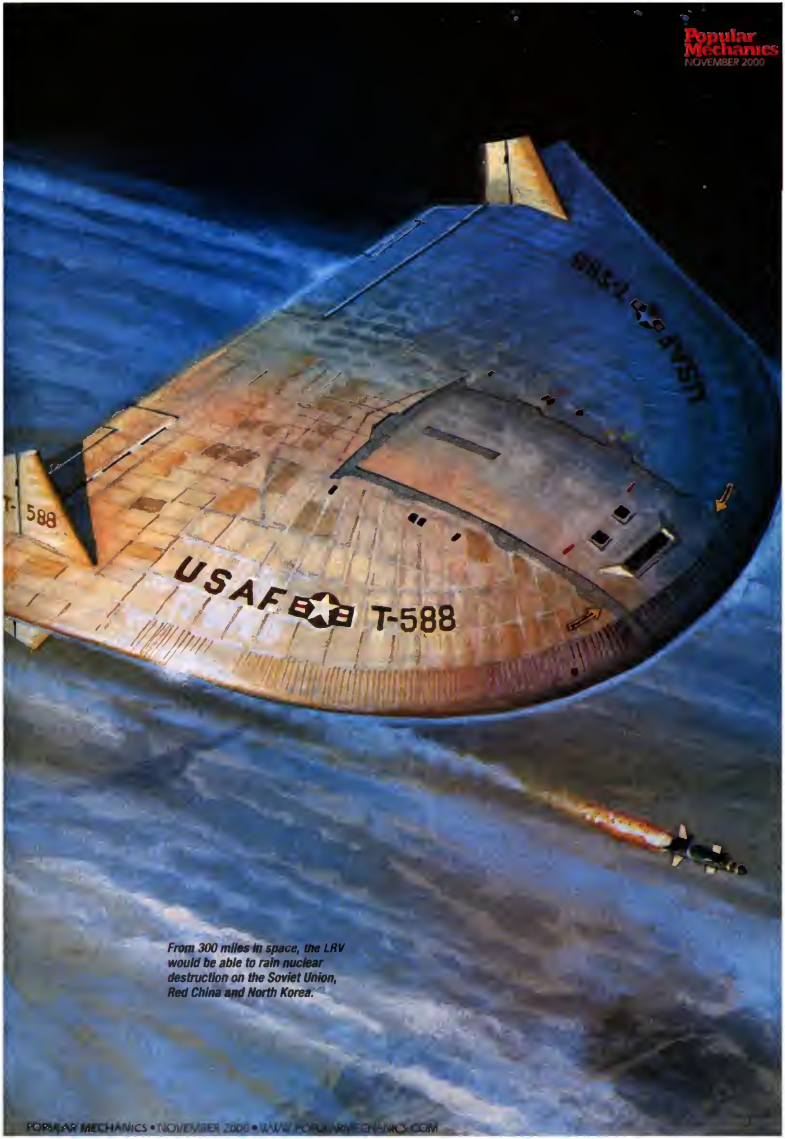
BY JIM WILSON, Illustration by Tom Freeman

In 1949, the biggest black hole in the universe wasn't in space, but across the Bering Strait. Stretching across 12 time zones, the Union of Soviet Socialist Republics was, as Winston Churchill would so memorably describe it, "a riddle wrapped in a mystery inside an enigma." The few things that most people knew about life behind the Iron Curtain seemed to be pieces of an incomprehensible puzzle. For the handful of intelligence experts who saw how the pieces fit, the "workers' paradise" presented a clear and present danger to the American way of life. What the intelligence community knew, and most people did not, was that in the final frantic hours of World War II, the Soviet army had hastily raided Germany's most advanced weapons research laboratories. And, on Aug. 29, 1949, only four years after Hiroshima, the technological booty from those raids turned a country whose farmers still used horse-drawn plows into a nuclear superpower.

COVER STORY

The fireball of the communist atomic bomb cast a sinister new light on an event that previously seemed quite inconsequential. In the summer of 1945, an unusual rumor had begun to circulate within the intelligence division of the European Command. During interrogations, captured German aircraft engineers referred to an extraordinarily fast rocket plane under development at a secret base in Bavaria. Unlike the Messerschmitt Me 163 rocket planes that had begun to attack Allied bombers in the last months of the war, this aircraft had an odd-looking curved wing that blended into its fuselage. The aerodynamic advantage of this configuration had been known to American designers for more than a decade. It created more lift than a standard wing, especially at low speeds, and provided more internal capacity for carrying bombs. In the early days of the war, the U.S. Navy had briefly experimented with circular wing design for those very reasons.

Anticipating that the first generation of communist atomic bombs would be as heavy as those America had dropped on Japan, it seemed reasonable to U.S. defense planners that the Soviet air force, which then lacked a nuclear bomber, would try to adapt German disc tech-



From 300 miles in space, the LRV would be able to rain nuclear destruction on the Soviet Union, Red China and North Korea.

"The operational mission design is six weeks at an orbital altitude of 300 nautical miles."

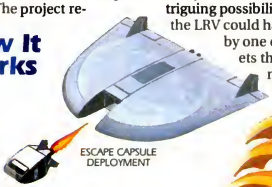
nology. The United States was, after all, doing exactly the same thing with the V-2s and Nazi rocket scientists it had spirited away in Operation Paper Clip.

In our July 1997 cover story, "Roswell Plus 50," POPULAR MECHANICS detailed how Air Force interest in duplicating Nazi technology led to two American flying disc projects. Project Silver Bug sought to build a vertical take-off and landing aircraft. Project Pye Wacket was to create small discs for use as air-to-air missiles. Documents declassified since then point to a third secret project, a 40-ft. "flying saucer" designed to rain nuclear destruction on the Soviet Union from 300 miles in space.

The official designation for America's nuclear flying saucer was the Lenticular Reentry Vehicle (LRV). It was designed by engineers at the Los Angeles Division of North American Aviation, under a contract with the U.S. Air Force. The project was managed out of Wright-Patterson Air Force Base, in Dayton, Ohio, where German engineers who had worked on rocket plane and flying disc technology had been resettled.

The LRV escaped public scrutiny because it was hidden away as one of the Pentagon's so-called "black budget" items—that is, a secret project that is incorporated into some piece of nonclassified work. On Dec. 12, 1962, security officers at Wright-Patterson classified the LRV as secret because: "It describes an offensive weapon system." The project remained classified until May 1999, when a congressionally mandated review of old documents changed the project's status as a government secret, downgrading it to public information. The Department of Defense did, however, successfully seek to have the document's distribution restricted to defense contractors. PM obtained its copy as the result of a Freedom of Information Act request.

How It Works



In normal operation, the LRV would use its saucer shape to dissipate re-entry heat and then provide lift for atmospheric flight.

Inside The LRV

"The operational mission design is six weeks' duration at a nominal orbital altitude of 300 nautical miles, with a crew of four men," according to the report. The weapons bay would hold "four winged weapons" that could be either launched or detached and parked on orbit. There are repeated references to the LRV launching weapons-carrying clusters.

A considerable part of the design study focuses on the details of building a 40-ft.-dia. airframe and strengthening it against the acceleration of 8 g's and wind shear it would experience during launch. However, no mention is made of the type of booster the disc would ride into space.

Most likely, the LRV would have flown atop a multistage rocket, like the Saturn booster used in the Apollo moon program. The engineering study, however, suggests a more intriguing possibility. At some point, the LRV could have been powered by one of the nuclear rockets then under development by the Air Force and the Atomic Energy Commission. Several of these rockets were in fact built and successfully tested in Nevada. Although the government claims all of its nuclear rocket program records have been declassified, a search of the Department of Energy (DOE) human radiation experiment database indicates otherwise. PM has learned that 40 cu. ft. of records related to the human health effects of the nuclear rocket program, compiled between 1956 and 1975, are stored in a secured location—Building 1001—at the Los Alamos National Laboratory in Los

The materials recovered from the Fraser farm bear a striking resemblance to LRV engineering drawings.

Lenticular Reentry Vehicle

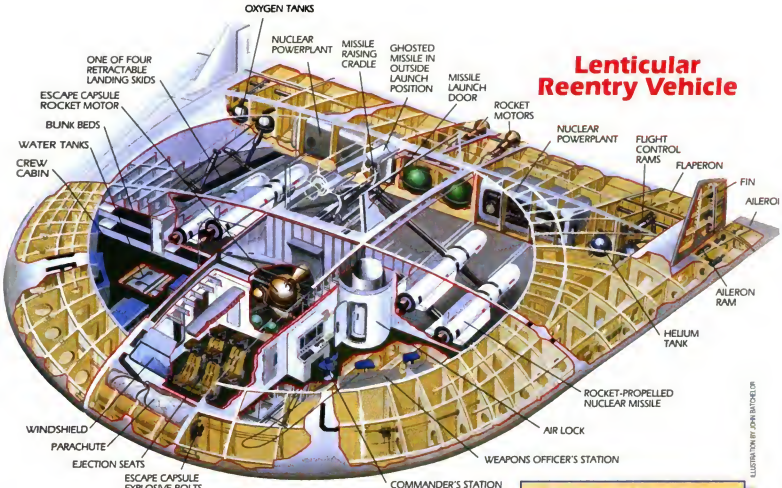


ILLUSTRATION BY JOHN BATCHELOR

Alamos, N.M. A DOE spokesman told PM that the only reason these records would have remained classified was if they dealt with an operational military system.

The four-man crew would ride a wedge-shaped capsule built inside the LRV. The capsule would divide the front portion of the disc into separate work and off-duty areas. The nuclear-tipped rockets would be stored in the rear segments.

Although these rockets were not called multiple independent reentry vehicles (MIRVs), they match the description of these multiple-warhead-delivery devices, which were later banned by disarmament treaties. An MIRV-equipped LRV would have been able to eliminate the war-making capabilities of the Soviet Union, China and North Korea at the push of a button.

In normal operations, the capsule would function as the LRV's flight control center. In an emergency, the crew could fire the capsule's independent 50,000-pound-thrust solid-fuel rocket motor and return to Earth. The capsule's final descent would be slowed by a parachute, much like the X-38 "lifeboat" planned for the international space station now under construction.

A textbook mission would conclude with the entire LRV returning to Earth. It would fire its nuclear or liquid-fueled main rocket to brake, then travel edge-first into the atmosphere. Its disc form would dissipate the heat of re-entry, then act as a wing. Its flattened tail structure would provide directional stability and control. A minute or so before landing, skids would extend and the LRV would settle onto a stretch of dry lakebed.

The engineering study does not describe how the LRV, which would weigh just over 17,000 pounds without its crew, weapons, fuel and stores, would then have been returned to the launch pad. One possibility, suggested by the inclusion of a high-pressure helium storage tank, is that it would have been ferried by a heavy-lift balloon, as shown in the drawing on the opposite page. While the LRV would not have had sufficient helium to inflate a balloon, the tank would have had sufficient capacity for replenishing the lift-bag to permit trips of several thousands of miles.

In 1997, as part of its effort to debunk the Roswell alien landing myth, the Air Force revealed details of several heavy-lift balloon research projects. Among those were experiments in which 15,000-pound payloads were lifted to 170,000 ft. While not specifically acknowledging the LRV by name, an Air Force spokesman conceded that during the Cold War it routinely used high-altitude balloons to

LRV Specifications

Crew	4
Weapons	4 nuclear missiles
Mission Length	6 weeks
Dimensions	
Diameter	40 ft.
Center	90 in.
Edges	6 in.
Wing	1548 sq. ft.
Weights	
Launch	45,000 lb.
Landing	33,395 lb.
Empty	17,042 lb.
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Booster	Chemical/Nuclear
Main	Hypergolic/Nuclear
Capsule	Solid fuel
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(Please turn to page 71)

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lift unusual airframes for aerodynamic tests. Airframe tests of secret planes were most likely the cause of still unexplained UFO sightings. And a balloon-lifted LRV test flight would certainly match the classic UFO reports of a silvery disc hovering motionless in the sky, then silently shooting upward.

Crash Debris

The engineering study obtained by POPULAR MECHANICS contains language that describes a re-entry heating test that, at the time, could have been accomplished by only a high-altitude drop of a flying prototype. A further indication that the LRV flew comes from a retired Air Force contractor. He tells PM he personally saw a craft fitting the description of the LRV at a Florida base that he had been visiting on unrelated business in the late 1960s. However, what is by far the most compelling evidence that the LRV, or a flying prototype, was actually built comes from Australia.

In 1975, Jean Fraser found an odd bit of honeycomb-like debris on her family's ranch south of Brisbane. The area is in the vicinity of what was then a secret Australian testing range where the British and Americans conducted some of their most secret atomic experiments. Since the LRV was to carry a small nuclear reactor to provide electricity for flight systems, it is conceivable that tests would have been conducted at this isolated location.

Local legends claim the honeycomb was debris from a flying saucer that exploded over the test range in 1966. The remaining pieces were supposedly collected by the military and returned to the United States aboard a U.S. Air Force plane. Interested in learning if the debris was extraterrestrial, Dick Smith, a Sydney businessman, arranged for the University of New South Wales to perform a chemical analysis.

The debris contained minerals commonly found in aircraft-grade fiberglass panels. Based on the university's report, the *Mufon UFO Journal*, the monthly magazine of the Mutual UFO Network (www.mufon.com), debunked rumors of the debris having any alien origin.

Unexplained Residue

PM became interested in revisiting the Australian debris analysis when we noticed a similarity between a photograph of the mystery honeycomb and a cross-section diagram in the LRV engineering study. We've put the two images next to each other on page 68. Let us know what you think.

We were also curious about two points that were raised in the university's chemical analysis, but not pursued once it was determined that the debris originated on Earth. The first has to do with the presence of small amounts of titanium. Titanium is a strong, lightweight metal used extensively in spacecraft. While some fiberglass products also contain titanium, it is not in the chemical form found in the debris.

The second curiosity has to do with chemical residues. Those found on the honeycomb were similar to those typically found in the vicinity of high-temperature chemical explosions. A possible explanation for such an explosion can be found in LRV engineering drawings. Like the German Me 163 rocket plane, the main engine of the LRV was designed to burn hypergolic fuel, highly reactive fluids that can explode on contact, releasing tremendous amounts of energy. Plans show that the LRV would have carried 9375 pounds of nitrogen tetroxide and hydrazine.

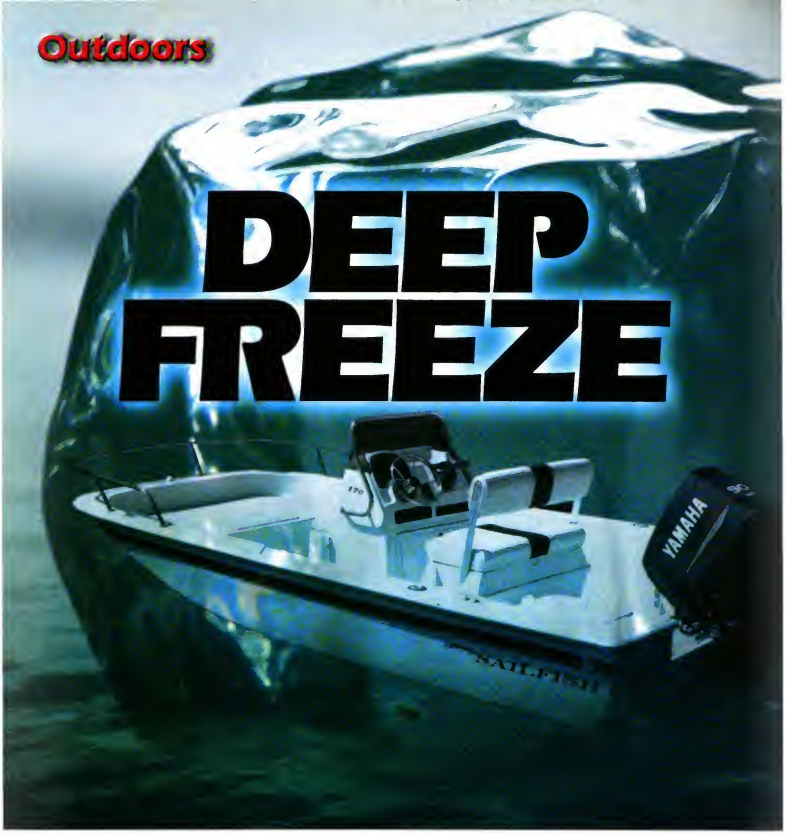
In Germany, landing Me 163s were plagued by on-board fires, caused by the sloshing of a type of hypergolic fuel in mostly empty fuel tanks. According to the design study, the tanks aboard the LRV could never be completely emptied either, making accidents like those aboard Me 163s all but inevitable. LRV project managers would have been well aware of this unique danger, as one of the members of the Wright-Patterson aeronautical research team was Rudi Opitz, one of Germany's first Me 163 test pilots.

LRV documents released thus far tell only part of the story. But in time, the secrecy on progress reports, construction drawings and perhaps even operational records will expire and we will be able to tell the rest of the story. Perhaps they will reveal that the LRV remained a general's pipe dream, a multimillion-dollar paper plane that never took flight. Or they may tell the story of the most astounding adventure in the history of flight. PM

Conseco (con-se
noun: an individual with
tremendous drive for fin
success. *e.g. Kenny built*
in his yard? Well, that cr
conseco deserves it.

CONS
S

DEEP FREEZE



Before you put your boat on ice for the winter, here's what you need to do to protect your investment.

BY CLIFF GROMER, Illustration by Danilo Ducak

Why put time and money into a boat that you're not going to use for six months? That's an all-too-common attitude when it comes to winterizing chores. *Beeeg* mistake. Winter weather can wreak havoc (cracked blocks, corrosion, etc.) on a boat that's not prepared for hibernation. Another tip: If your boat needs professional help and you wait until spring to get it, you're hitting the boat doctor at his busiest time. So it pays to take care of any problems and dealer-required maintenance in the fall, before your craft is clutched by winter's icy grip.

BOATING

The Hull Story

Winterizing is more than just sloshing in some fuel stabilizer, draining the engine and adding antifreeze. Consider it to be a methodical process that runs from bow to transom. Because boats and engines differ, start by checking the winterizing/storage sections of your owner's manual.

Thorough pressure washing of the bottom will clean off the crud and slime. Then you can attend to any scraping and painting that's needed.

Fiberglass is made to stand up to the ravages of summer sun and salt water, so a little snow is not a problem—or is it? Ice accumulation can split open hatches and window tracks, causing leaks. So outside storage demands the proper boat cover. More on this later.

Check the hull, looking for stress cracks (common around the bow eye) and gelcoat blisters. Stress cracks can indicate structural damage, and anything serious should be looked at by a professional. The drill with blisters is to puncture, drain, dry and patch with an epoxy-based filler made for this purpose. If your hull is aluminum, bang the drum slowly with a rubber mallet to knock out dents.

Barnacles and any other unwelcome guests tagging along on your boat bottom should have their free-ride privileges terminated by scraping and then sanding any residue. A good pressure washing is in order to remove dirt and the dreaded sea scum. You'll make this job a lot easier in the future if you apply a product such as 3M's Marine Ultra Performance Paste Wax. It creates an acrylic shield over the hull to prevent dirt from penetrating into the wax. The crud stays on the surface where it can be hosed off easily.

Inside Scoop

Winter air can be humid or dry, and both conditions can bring grief to vinyl interiors. Vinyl cleaners and protectants, available in gels and sprays, can prevent your vinyl from drying out and cracking. More insidious is moisture that opens the door to mildew. More than one boat owner has unzipped his boat in the spring only to find the interior looking like a science project with mold and mildew everywhere. The fix here is to vent your boat cover for good airflow to minimize trapped moisture. Mildew sprays are a big help, as are chemical dehumidifiers that pull excess moisture from the air.

"Earmuffs" attach to the lower unit for flushing outboards and sterndrives.

Gelcoat blisters need to be punctured, drained and filled with special epoxy.

Not content with just getting cozy with your interior, moisture likes to do other nasty things, like corrode your on-board electronics and electrical system. If your wiring is of the

ILLUSTRATIONS BY RADOVAN VARCAK

Drain the gear oil and check it for moisture and contaminants—indicators of a problem that should be corrected—before pumping in fresh lube.

nonmarinized variety, it's especially prone to corrosion that can cause shorts, blown fuses and a big migraine—with a large service bill to match. Remove any electronics that you can, and let them winter in a kinder environment. Then, spray all exposed electrical connections with a moisture-displacing lubricant. Now is also the time for a thorough cleaning of all brightwork, vacuuming/washing of the carpets and deck, and a general overall grime-busting expedition.

If your boat has a removable head, clean and dry it before you store it. Built-in units, including sinks and showers, should be drained and pumped with antifreeze.

When choosing a boat cover, make sure the cover protects the waterline. Polytarp covers are relatively inexpensive but, as with any cover, they should be used with a frame to distribute the weight of snow evenly and away from the weak areas of the boat. You can make your own frame from 2 × 4s or 2 × 2s or PVC pipe. There are also kits that allow you to make a reusable frame from aluminum tubing using special clamps that attach the tubes at any angle.

Polyvinyl covers are often used for maximum water repellency and resistance to mildew and stains. Be sure the cover is securely tied down or taped so wind won't get underneath the cover, blowing in snow or shredding the cover itself.

Engine Winterizing Guide

Maintenance	Outboards	Inboards/ Sterndrives
Add gas stabilizer	✓	✓
Check plugs, wires, rotor, cap	✓	✓
Check belts, adjust tension		✓
Check hoses	✓	✓
Clean fuel screens, replace fuel filter	✓	✓
Check shift/throttle cables and settings	✓	✓
Lube shift/throttle cables and linkages	✓	✓
Flush cooling system	✓	✓
Drain block, manifold, circulating pump and coolers		✓
Fill block, manifold and circulating pump with antifreeze		✓
Change gear lube	✓	✓
Change oil and oil filter	✓	✓
Check gimbal bearing		✓
Grease U-joints and gimbals		✓
Lube engine coupler splines		✓
Check/replace sacrificial anodes	✓	✓
Fog engine	✓	✓
Check steering and power trim fluids	✓	✓
Touch up nicks and scratches	✓	✓
Check propeller/hub	✓	✓
Check/lube splines	✓	✓
Replace water pump impeller	✓	✓
Spray electrical connections with moisture repellent	✓	✓
Spray entire engine with anticorrosion treatment	✓	✓
Check fuel line and bulb	✓	
Remove battery and recharge if necessary	✓	✓

Motor Matters

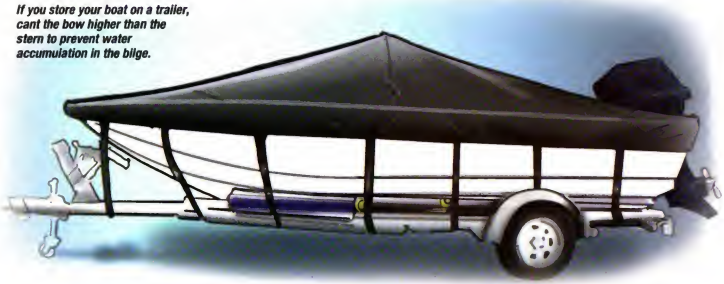
Winter's biggest dangers to engines are freezing, corrosion and fuel degradation. Pull the engine cover and check for such problems as

Check the water pump (some folks replace it every year) and shaft seal. Lube prop splines.

frayed or loose wires, connections and clamps. Check the condition of all hoses and replace those that are mushy or that show cracks. Check the condition of the belts and adjust the tension if necessary. Touch up any paint nicks to prevent corrosion. Run the engine up to temperature and change the oil and filter.

ILLUSTRATIONS BY RADOVAN VARCAK

"The main jets in the carb are so small that even a tiny amount of fuel can gum them up."



If you store your boat on a trailer, cant the bow higher than the stern to prevent water accumulation in the bilge.

Flush the engine with fresh water. Some outboards have an attachment for a garden hose to make the job easier. Otherwise, use "earmuffs" to reverse flush outboards and sterndrives. Idle the engine when flushing, making sure it doesn't overheat, until the water flushes clean. Clean all outboard telltales with a piece of wire, and store the engine in a vertical position to make sure the water drains completely. Even a small amount of water left in the engine can freeze and cause big damage. Inboards and sterndrives require refilling with propylene glycol antifreeze to prevent small ice pockets from forming, which can crack the block.

Squirt fogging oil down the carburetor while the engine is running.

Gasoline breaks down in storage—the lighter factions evaporating off and the heavier ones forming a jet-clogging and injector-sticking varnish. The degrading action can begin in as little as two weeks, and the fuel's octane rating decreases in the process. Add fuel stabilizer to the tank and idle the engine for 10 to 20 minutes to distribute stabilizer throughout the system.

To protect engine internals from rust and corrosion, remove the engine flame arrestor and spray fogging oil down the carburetor with the engine running. Shut off the fuel supply—either with the fuel valve or by pinching off the fuel line—to burn up the remaining fuel in the carb/fuel-injection system.

Remove float bowl drain plugs on all carbs to prevent residual gas from gumming up jets.

When the engine stops, pull the spark plugs and squirt some fogging oil into the cylinders. Rotate the engine a few times for a good oil coating and reinstall the plugs. An alternative is to disable the ignition and crank the engine while spraying fogging oil down the carb.

Fogging oil is relatively sticky, and there's a possibility of it hanging up an injector if it's used on fuel-injected engines. To be on the safe side, use two-cycle oil instead of fogging oil, following the above procedures. Also, add some two-cycle oil to the fuel along with the stabilizer.

On four-cycle engines, the main jets in the carb are so small that even a tiny amount of fuel left in the carb can gum them up. You need to remove the carb drain plug to extract all of the fuel.

Moving to the stern end, wedge a block of wood between the prop and antiventilation plate, loosen the prop nut and pull the prop. Check the condition of the prop, hub and splines. Changing the water pump impeller is cheap insurance against water pump failure next season.

Drain the gear case lube and look for a milky color, which would indicate water in the oil. Also look for metal chips, which mean your gears are grinding more than horsepower.

If you're conscientious about winter maintenance, your reward will be a quick launch in the spring—instead of time spent stuck on the trailer. PM

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It's the ultimate Ford vs. Chevy showdown, but this time, it's personal.

BY DON CHAIKIN, Photos by Bill Delaney

More intense than the

COMPARISON TEST

Hatfields versus the McCoys. More deeply rooted than Army versus Navy. Longer lived than Ali versus Frazier. The greatest rivalry on our roads dates back to 1911 when Chevrolet was born and threw the gauntlet down before Ford. In fact, there are few feuds in this world that can divide a room, a family, or an entire superspeedway's grandstand, as quickly and as vividly as Chevy versus Ford.

Over the decades, the two carmakers have been nipping at each other's bumpers and banging door handles in all areas with all kinds of vehicles. But for us plain folk, the most meaningful of the bragging rights are those earned after a stoplight-to-stoplight dash. And that kind of honor is won by a car that can go fast and get there quickly. And here in the dawn of the 21st century, both Chevy and Ford upped the performance ante—practically in unison.

Both the Chevrolet Corvette Z06 and Ford SVT Mustang Cobra R represent their respective makers' ultimate in streetable performance. Anyone with enough paycheck and desire can stroll into the appropriate new car dealer and sign on the dotted line to own either one of these. Of course, given the laws of supply and demand, putting your name down now simply gets you on the waiting list.

Both cars were created to be fast, agile and, perhaps most importantly, quicker than anything available before, either from its own maker or from the other.

MATCH

But we all know that one must be quicker than the other. And since we're often called upon to help settle such arguments, we decided to see exactly which one it is. So we took a bright yellow Corvette Z06 and an equally bright red Mustang Cobra R to the asphalt aisle known as Old Bridge Township Raceway Park, near Englishtown, N.J. Then we hammered them.

It should be noted that we ran these cars on a relatively hot summer day, so the times and speeds we recorded may not be as good as they could have been during more optimal conditions. But the cars were run side by side, swapping lanes with runs for consistency, so the results are solid. And it was close.

Chevrolet Corvette Z06

Back in late 1962, legendary Corvette chief engineer Zora Arkus-Duntov created a special option package for the '63 Corvette Sting Ray. The option was labeled Z06. This package raised the base price of the split-window Sting Ray coupe by more than half and included all the requisite go-fast goodies of the day. Only 199 of these cars were built, but one of them won the L.A. Times Three-Hour Invitational Race at Riverside Raceway. Among the cars the Vette beat was Carroll Shelby's Ford-powered Cobra, which was making its debut as well. As you can see, the seeds of this particular grudge were sown nearly 40 years ago.

Chevy had no intention of letting Ford get revenge. For 2001, Chevrolet has resurrected the Z06 designation. As it was then, the Z06 is meant to be an out-of-the-box, high-performance, racetrack-ready car. The current Z06 package comes with a stiffer, race-tuned FE4 suspension, a Tremec six-speed manual with overall lower gearing for brisker-than-standard acceleration, monster-truck-size tires and a special version of the standard Vette's small-block V8. Along with the coveted Z06 designation, the Bowtie group also resurrected another glorious code from its past: LS6. In 1971, Chevy offered the LS6—a 425-hp big-block 454 cu.-in. option for the Corvette. Only 188 were built.

The modern-day LS6 is based on the regular Vette's 5.7-liter LS1 V8. The LS6 comes with higher compression (10.5:1 versus 10.1:1), a higher-lift, longer-duration camshaft, stiffer valve springs, different pistons, reduced internal resistance, better breathing, and injectors that deliver more fuel. All that means the LS6 develops 385 hp at 6000 rpm and 385 ft.-lb. of torque at 4800 rpm.

But as any racer knows, it's not just about power, it's about how much weight that horsepower has to move. So Chevy used the Corvette hardtop—the lightest version of the car—and shaved its weight by using thinner windshield and backlite glass, a unique titanium exhaust system and other tweaks. The result is a car that tipped our scales at 3122 pounds. That's 1 hp for every 8.11 pounds of car. All of that fat trimming, however, didn't go deep into the car's comfort. The Z06 still has the same full interior as lesser Vettes, complete with stereo, a/c, carpeting and power everything.

That muscle and that weight translated into a quarter-mile run of 12.81 seconds at 111.19 mph. And that beats the Cobra R. For the record, the Vette was also quicker to 30 mph and 60 mph, stopped in less distance and posted a higher skidpad speed.

In our August 2000 issue, we said that the Z06 was the fastest and quickest Corvette—ever. It's also the quicker of these two.

Ford's SVT Mustang Cobra R is powered by a tweaked 5.4-liter V8 from the Lincoln Navigator. This road-going racer has Brembo front disc brakes, which are cooled via ducts. A serious fuel-system vent and a can't-miss-it rear wing announce Cobra R's purpose.

Ford SVT Mustang Cobra R

As we said, it's all about power to weight. And though the Mustang Cobra boasts 385 hp and 385 ft.-lb. of torque, just like the Z06, it tipped our scales at 3595 pounds. That's 473 pounds more avoirdupois than the Vette, and gives the car a power-to-weight ratio of 9.34:1. And that, friends, makes all the difference.

The crew at Ford's Special Vehicle Team, better known as SVT, took a tried-and-true approach when developing their car, one similar to that used by Chevrolet. They, too, resurrected an older model designation. There were two previous Mustang Cobra Rs: 1993 and 1995. For this latest version, they first stuffed a bigger engine into a Mustang, and then they chucked as much bulk from the car as they could. Along the way they stiffened its suspension, put some huge tires over humongous brakes and fit in the best-sounding exhaust system this side of a Winston Cup car.

The SVT replaced the car's 4.6-liter V8 in favor

For More On Automobiles
Check the Automotive channel on the PMZone Web site at popularmechanics.com/auto

SPECIFICATIONS AND DIMENSIONS

VEHICLE MANUFACTURER & MODEL	BASE PRICE/ PRICE AS TESTED	ENGINE TYPE/DISP. (liters/cu. in.)	ENGINE HP, SAE NET/ TORQUE (ft.-lb.)	COMPRESSION RATIO/FUEL TANK (gal.)	TRANS. TYPE/ REAR AXLE RATIO, TYPE	GEAR RATIOS 1/2/3/4/5/6	WHEELBASE/ LENGTH (in.)	TRACK F/R (in.)	WIDTH/HGT, WEIGHT BIAS (% f/r)	ACTUAL WEIGHT (lb.)/ WGT/HP	HEADROOM/ LEGROOM (in.)	CARGO VOLUME (cu. ft.)	STEERING TYPE/RATIO (overall)	TURNING CIRCLE (ft.)
Chevrolet Corvette Z06	$47,500/ $48,125	OHV 16v V8/ 5.7/345.7	385 @ 6000 rpm/ 385 @ 4800 rpm	10.5:1/ 18.5	6M/3.42:1, limited-slip	2.97/2.07/1.43/ 1.00/0.84/0.56:1	104.5/ 179.7	62.4/ 62.6	73.6/47.7, 53/47	3122/ 8.1	37.8/ 42.7	13.3	power rack & pinion/16.1:1	42.3
Ford Mustang	$54,995/	DOHC 32v V8/	385 @ 6250 rpm/	9.6:1/	6M/3.55:1,	2.97/2.07/1.43/	101.3/	59.7/	73.1/52.2,	3595/	38.1/	[illegible]	power rack & [illegible]	41.6

"The seeds of the Z06 versus Cobra grudge were sown nearly 40 years ago."

of a stronger 5.4-liter version from the Lincoln Navigator. This required new engine mounts, lowering the front crossmember and creating a nasty, bulging hood. The V8 was tweaked with a forged crankshaft, forged aluminum pistons, Carillo billet-steel connecting rods and a compression ratio of 9.6:1. At the engine's bottom there's a baffled oil pan with a windage tray. At the top are reworked cylinder heads that offer 25 percent greater breathing than the stock 4.6-liter heads. New camshafts offer more lift and duration than stock, too.

The exhaust manifolds are tubular steel headers that connect to a Bassani X-pipe under the car, then to dual Cobra catalytic converters, Borla mufflers and then pipes that exit from under each door.

The steroided 5.4-liter drives through an aluminum flywheel to a Tremec six-speed manual, just like the Vette. However, while the Vette's gearbox is mounted at the differential in a transaxle unit, the Ford's is right behind the engine.

Even more aggressive than the power-boosting plan were the SVT's weight-reduction methods. Gone is the car's back seat, radio, sound insulation and all sorts of trim. If the lack of luxury doesn't tip you off to this car's ultimate purpose, then consider the fact that in place of the stock fuel tank you'll find a 21-gal. fuel cell. Front brakes are 13-in. vented Brembo discs with four-piston calipers, which are cooled via ducts that breathe through openings in the airdam. Rear brakes are stock Cobra, with thicker linings.

Suspension is about 40 percent stiffer than a regular Mustang Cobra with Eibach coil springs and Bilstein shocks all around.

All of this makes for a Mustang that ran a 12.87-second, 110.55-mph quarter-mile. But, it's a tough car to live with if you're not going racing. It's loud—which can be good—and harsh and very hot inside. But the folks at Ford know that. That's why they built only 300. PM

Chevrolet's Corvette Z06 comes with a special suspension package and the LS6 V8, recognizable by its red valve covers. Disc calipers are red, too, just like a Porsche's, and they're cooled via ductwork in the car's nose.

TEST RESULTS

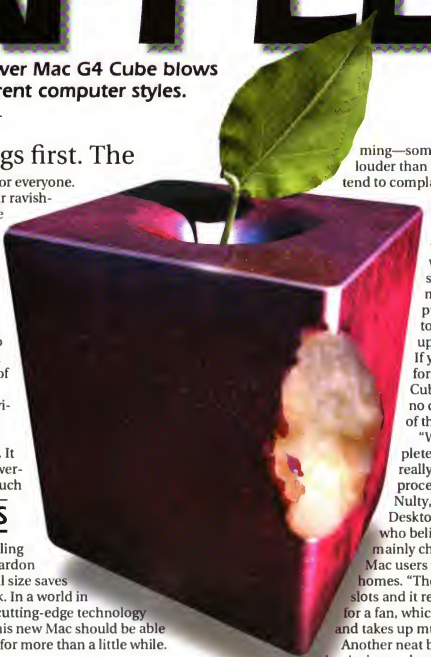
WHEEL SIZE (front/rear) & TYPE, TIRE BRAND & MODEL	TIRE SIZE (front, rear)	SUSPENSION SYSTEM CONFIGURATION (front/rear)	BRAKE SYSTEM TYPE (front/rear) DIAMETER (in. tr)	ACCELERATION 0-30 MPH (sec.)/ 0-60 MPH (sec.)	ACCELERATION[1] 1/4-MILE (sec./mph)	PASSING[2] 45-70 MPH (sec.)	BRAKING[3] 60-0 MPH (ft.)	BRAKING[3] 30-0 MPH (ft.)	SKIDPAD[4] 200 FT. (lateral g)
5/18x10.5-in. forged alloy, lyster Eagle F1 Supercar	265/40ZR17, 295/35ZR18	leaf, A-arms/ leaf, A-arms, toe link	disc/disc, ABS 12.8 vented/12.6 vented	2.06[5]/ 4.58[5]	12.81/111.19[5]	2.89	109.44	28.24	0.92[11]
18x9.5-in. cast alloy, Goodrich g-Force T/A[10]	265/40ZR18, 265/40ZR18	coils, low arms, mod. struts/ coils, A-arms, toe link	disc/disc, ABS 13.0 vented/11.7 vented	2.20/ 4.69	12.87/110.55	3.01	111.89	28.10	0.90

2. Best time from 40 to 70 mph 3. Best stop hot or cold 4. Max g-force around a 200-ft -dia. circle. Average of best cw and ccw 5 w/traction control off 11 w/Active Handling off

APPLE 3

Brand-new Power Mac G4 Cube blows the top off current computer styles.

BY TOBEY GRUMET



First things first. The Apple G4 Cube is not for everyone. Granted, it does appear ravishing enclosed in its cage of crystal-clear plastic. But the G4 Cube is also powerful—so powerful, it may not be right for first-time computer buyers.

Created to cater to professional users who need G4 capability but like the look and ease of use they get with the iMac, Apple's newest vision is an 8-in. snow-white cube, embossed with a blue Apple logo. It houses a 450-MHz PowerPC G4 processor and such

COMPUTERS

features as a silent cooling system and Harman Kardon speakers. And, its small size saves you room on your desk. In a world in which it seems a new cutting-edge technology surfaces every week, this new Mac should be able to hold your attention for more than a little while.

Clear To The Middle

Okay, so we've established that the Cube is to computer users what the Guggenheim Museum Bilbao is to architects: modern, daring and eye-catching.

Apart from its size, what else makes it so different from other machines? Its cooling system, for one thing. Most desktop computers use a fan to cool the innards of the machine. If you've got a computer tower, lean over and place your ear near it when it's running. You'll hear a distinct humming—some fans can be much louder than others. Many people tend to complain about the noise. So Apple decided to get rid of it.

A center convection cooling area lined with heat syncs runs straight through the middle of the Cube, pulling air from the bottom of the computer upward through the top. If you know what's good for you and your new Cube, you'll make sure no chatchkas go on top of this computer.

"We think that a completely silent computer really adds to the creative process," says Linda McNulty, Apple's director of Desktop Product Marketing, who believes the Cube will be mainly championed by Power Mac users who work from their homes. "There are no PCI cooling slots and it really negates the need for a fan, which just makes noise and takes up much-needed space."

Another neat benefit of the Cube is that its inner electronics can be easily removed. This can make life a lot easier when you want to either upgrade the memory or add an Apple AirPort wireless card, which also can be used to access the Internet on any iBook, Power Mac G4 or PowerBook G3 you may have lying around. Just turn the Cube upside down, push a button and pull the built-in plastic handle. The insides will slide right out.

The power cord attaches from the underbelly of the computer, where you'll also find two FireWire ports and two

For More On Technology
Check the Technology channel on the PMZone Web site at popularmechanics.com/tech

ILLUSTRATION BY PAUL DIMARE

USB ports. But beware, it's hard to get anything plugged in once the Cube is on your desk and running. You can tip the Cube over to get to the ports but, unfortunately, it tends to go to sleep during this process. It takes a bit of practice, but you should eventually be able to master this without causing your Cube to shut itself down.

The top of the computer houses what is called a proximity button, which is really just an icon that you touch lightly to turn the machine on. Definitely different, but once you get used to it, you may start trying to turn your toaster on that way. Also on the top is a slot-loading DVD drive, so there's no messing with disc drawers. "We really just looked at what you need next to you most of the time," says McNulty. "We checked the profiles of our professional customers who use G4s in their homes and made it all more personal and friendly—with no compromise on power."

What's Attached

If you're on your computer much of the day, like most folks who would be willing to pay the $1799 for a G4 Cube, you are probably fond of listening to music or at least making sure your sound system is good enough for Internet and computer audio capabilities or video games. Look out, because the new Apple-designed Harman Kardon speakers are not only of excellent quality (in true Harman Kardon fashion), but really neat to look at. About the size of softballs with the look of some eyeball-shaped toy you may have gotten from a 25-cent vending machine, these speakers put out a whopping 20 watts of sound with a frequency range between 80 Hz and 20 kHz. If you're looking for an even heftier sound system to attach to your Cube, Harman Kardon makes a product called SoundSticks, based on the design of the iSub that came out earlier this year for iMacs. SoundSticks includes a powered, three-amplifier subwoofer and two satellite speakers and retails for $199. Remember, all of this sound comes from plugging your speakers into the USB hub.

Also packed with the Cube is Apple's new optical mouse and professional keyboard. This mouse wears a clear plastic case and, on top of looking too cool, it works on any surface, without a mousepad. The full-size keyboard includes two extra USB ports, has 108 keys and includes volume-control and disc-eject keys. This keyboard and mouse are now standard for the entire Mac product line.

The Cube is preinstalled with Apple iMovie! 2 digital video-editing software featuring an easy-to-use interface and tools that let you, among other things, create a soft focus and speed up or slow down video clips.

Behold—the magnificent Power Mac G4 Cube takes center stage.

What You See

Now that all your processing needs have been taken care of, how about a monitor to finish it off? Apple gives you a few options with the Cube—something to fit any lifestyle. The monitors are sold separately from the computer and you can choose between a flat-panel display and a CRT. The flat-panels come in 15-in. and 22-in. varieties, running for $999 and $3999, respectively. But put one of these babies together with your Cube and you've got one bee-u-ti-ful system. The 17-in. CRT monitor will run you only $499, but defeats the purpose of buying this space-saving system.

In case you're looking for an extra kick, Apple is also offering a 500-MHz version of the Cube with 120MB of memory and a 30GB hard drive for $2299—only available from the Apple Store at www.apple.com. PM

Curves don't throw it.

Actually, let us amend that. Curves don't throw them.
Because although the all-new 2001 Dodge Stratus R/T
Coupe and Stratus ES Sedan approach the subject
of performance and handling differently, both do it brilliantly.
Both come with a touring suspension standard. (The Coupe
goes the Macpherson strut/multilink route, while
the Sedan uses a race-inspired double wishbone approach.)
To add to the already superb handling, big, wide wheels and
tires are standard. (16" on the Sedan, and a mammoth
17" on the Coupe.) And while we've thought the curves out
very carefully, we certainly didn't stop there. As evidence,
we offer the fact that both come with engines in the
neighborhood of 200 peak horsepower. Which, believe you us,
handle straight ahead assignments very expeditiously.

The Coupe.

And the Sedan.

We red your mind.

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Always use seat belts. Remember, a backseat is the safest place for children 12 and under.

COMBO CAMERA

The new I-Zone Digital & Instant Combo Camera bridges film and digital photography.

BY TOBEY GRUMET

Everyone loves photos.

They're memories and keepsakes—snapshots of favorite moments. So it's no surprise that with the meteoric rise in the popularity of digital photography, Polaroid has once again shown its inventive side with the new I-Zone Digital & Instant Combo Camera.

As with its original Instamatic camera, Polaroid is betting that nobody likes waiting to have film developed. Life is busy. Time is money. Instant results are key. And whether you want pocket photo stickers or high-quality digital images, you'll be dually excited about the Combo Camera. It's two cameras in one: Look through one side to take instant photos—turn it around and use the other side for digital photos.

If you're going on vacation or to your sister's wedding—anytime that getting high-quality photos is of importance—you may want to think about a more traditional camera (see "What's Hot In Photography," Oct. 2000, page 58). But if you're on your way to a reunion with your college roommates or a weekend at the beach, this sleek and lightweight Combo Camera is a pretty cool companion.

PHOTOGRAPHY

The Polaroid I-Zone Combo Camera lets you choose your poison.

For Technology News And Story Updates
Check the Technology channel on the PMZone Web site at popularmechanics.com/tech

Zoning In

The I-Zone camera is no newcomer to the camera cotillion. Although the $99.99 Combo Camera is a new release, the Polaroid I-Zone pocket camera, launched last year on Labor Day, has already become a hit, allowing users to take instant, stamp-size photos and photo stickers. Remember those curtained-off photo booths you could run into after a swim in the ocean, or at the mall with your friends? The I-Zone cameras are reminiscent of those, giving people the chance to take small, personal snapshots for their wallets or to stick on an office computer or school notebooks.

Once Polaroid realized the popularity of the I-Zone pocket camera, the company decided to embark on what seemed like the logical next step.

Simply a digital camera combined with a pocket camera, the Combo Camera stores up to 18 digital images at 640 × 480 resolution. These digital photos can then be uploaded to a PC with a serial cable that is packaged with the camera. PhotoImpression 2000 software is part of the bundle, letting you temper digital photos with more than 30 special effects.

With The Web

To make the Combo Camera truly up-to-date, a Web site was created to accompany the product. After you take a digital photo with the Combo, you can upload it to the I-Zone Web site (www.izone.polaroid.com), where you can use fun, easy-to-use editing features to alter your digital masterpieces. As this article was being written, Polaroid was in the final stages of fine-tuning the I-Zone site and the editing tools, according to spokesman John Hollywood. "Obviously, you'll be able to upload pictures to the site," he says. "You'll also be able to create chat rooms where you can post your digital photos and show them off. You'll be able to have a personal area that will be password protected—for friends and family—or display your pictures to everyone on the Web site."

Another feature will be what is essentially a slide show. Polaroid envisions a place where you'll be able to turn your still photos into a flip book for a different effect.

The site was formed in alliance with RDA Interactive and iPIX to ensure its technology was cutting edge.

Instant Gratification

The Web-enabled tricks are impressive, but don't forget the more practical, instant features. Say you're having a party—you simply take out your Combo Camera, turn it on with the small switch on the top of the box and press down the button. For immediate results, pull out the small bit of film sticking out the side of the camera and you've got your picture, which will appear in a matter of minutes. Depending on which film you use (Polaroid's Pocket Film or Pocket Sticker Film), you can put your photo in your wallet or stick it on the bathroom wall for all to see. Face it, this is fun stuff. **PM**

As you can see, these little photos can be stuck anywhere—but you may not want to use the Combo Camera for your more serious photo ops. The digital side will let you share your photos with friends and family via the Internet.

Automotive

PARTY DOWN

Tell us how you would tailgate, and win our ultimate mobile party unit.

BY DON CHAIKIN, Photos by Bill Ashe

By nature, we Americans are

READER CONTEST

participants. And, by and large, we're a gregarious group, as well. So even when we go to a sports event where most of us will be spectators, we still try to participate—somehow. We scream, we do the wave, we wave a big ol' foam finger, we paint our faces—we do something. And many of us do our participating before the sports spectacle even starts, in the parking lot. And we do it with lots of our friends and fellow fans. Be it before the Daytona 500, a Jets game at the Meadowlands or the Rolling Stones' next final tour, folks like to get involved by having something to eat, something to drink and something to discuss outside the arena.

Trouble is, we've never been quite satisfied with any tailgating setup. So, we decided to build one that met all of our criteria. And we're going to give it away to one of you. We built a unit to our standards, needs and likes. Now we're giving you the chance to tell us what you would do by having a Build The Perfect Tailgater Contest. And the winner gets the unit shown here.

EZ-In/EZ-Out

We designed and built an entertainment module that slides into and out of the back of a typical, full-size van.

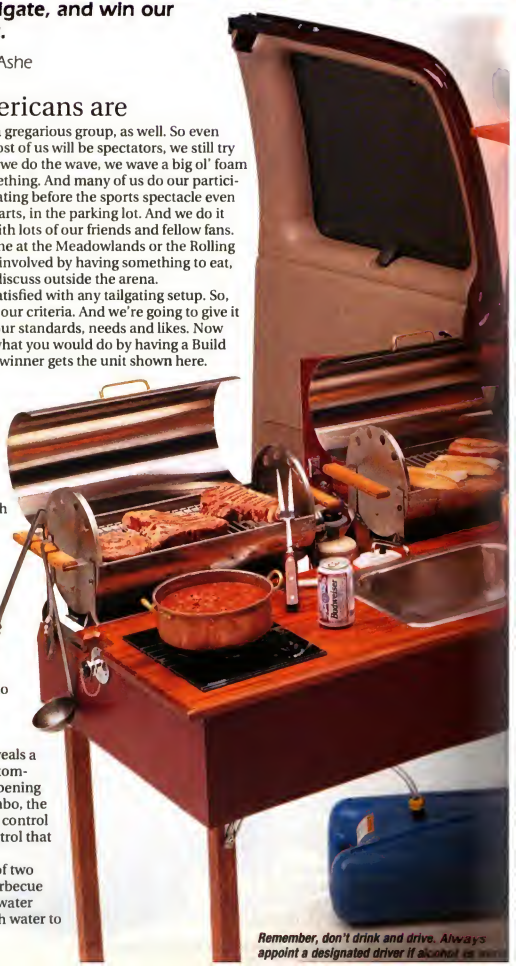
We created a welded-steel platform that attaches to the same mounting points that hold the van's rear seat. This platform has two tracks that match the tracks on a welded-steel dolly. Roll the dolly up to the rear of the van, pull the locking pins and slide the entire unit out onto the dolly. The same pins that lock the unit in place in the van do the job on the dolly.

However, our tailgater has more than enough bulk to settle any van down a couple of inches in the rear when loaded. So we opted for a set of Air Lift helper springs on the rear axle to raise and lower the van as needed.

The Fruits Of Our Labor

Opening the unit's two lower doors reveals a slide-in Norcold refrigerator and a custom-built slide-in food-preparation unit. Opening the hatch reveals the RCA TV/VCR combo, the Pioneer 50-disc CD changer and audio control unit, and the DIRECTV satellite TV control that gets its signal from U.S.S.B.

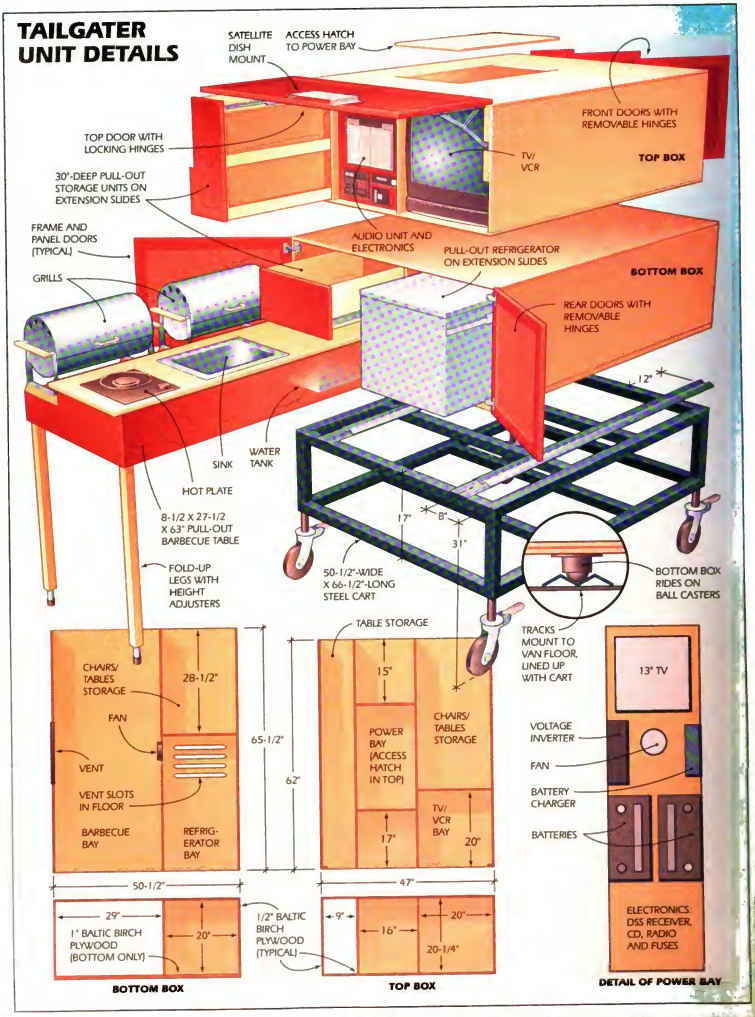
The food-preparation unit consists of two propane-canister-powered covered barbecue grills, a stove-top burner and a sink. A water tank beneath the counter supplies fresh water to



Remember, don't drink and drive. Always appoint a designated driver if alcohol is served.

—ANYWHERE

TAILGATER UNIT DETAILS



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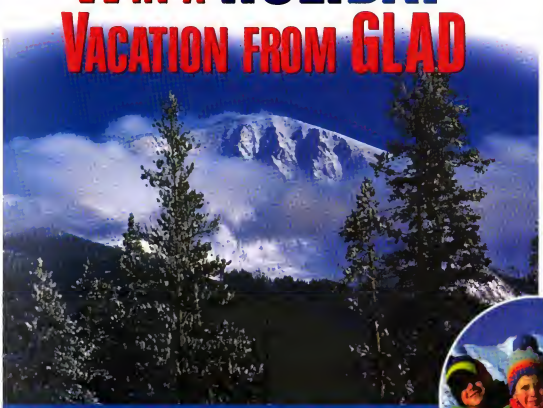

Enter to Win the "Peak of Freshness" Sweepstakes!

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Print your name, address and phone number on a 3" x 5" card and mail to:
"Glad Peak of Freshness" Sweepstakes
P.O. Box 1754
Sandusky, OH 44870-1754

Entries must be postmarked by December 23, 2000 and received by December 30, 2000.

"PEAK OF FRESHNESS" SWEEPSTAKES OFFICIAL RULES:

1. ENTRY: No purchase necessary to enter or win; one will a publicity [illegible] the chance of winning. Hand print your full name, address (city, state or province and zip or mail code) and phone number on a 3" x 5" card, and mail it, postage pre-paid to: "Peak of Freshness" Sweepstakes, P.O. Box 1754, Sandusky, OH 44870-1754.

2. LIMITATIONS: Each entry must be postmarked by December 23, and received by December 30, 2000. Only one entry per household. No mechanical or photocopied reproductions. Open only to legal residents of the 50 states, D.C., or Canada (excluding Quebec) who are not employees of the Clorox Company ("Sponsor"), Fairchild Publications, their respective parent subsidiary or affiliated companies, the advertising, promotional or fulfillment agencies of any of those (individually and collectively, "Entities"), and members of their immediate families or households. The Entities are not responsible for missing, stolen or inaccurate, forged, incomplete, stolen, lost, illegible, mutilated, damaged, misprinted which, postage due, misdirected, delayed or late entries or mail, each of which will be disqualified. Void where prohibited or restricted by law and subject to all federal, state, provincial and local laws and regulations.

3. PRIZE: Three (3) GRAND PRIZES: Six (6) days/five (5) nights trip for a family of four (4) to Winter Park, Colorado (including accommodations for four (4) in a deluxe three bedroom Dwelling or Hotel with a private hot tub, round-trip coach air transportation between the nearest metropolitan airport serving Winter's Home and Denver International Airport, airport/Dwelling/Hotel transfers, three (3) days skiing at Winter Park Resort for four (4) persons, including lessons, lifts and rentals; one (1) dinner at a hand-picked restaurant, one (1) dinner at a restaurant at the Cooperative Village, OR a Dog sled hide with a retired Alaskan Huskies. All expenses not specifically mentioned herein are not included and are solely the winner's responsibility. Travel and lodging are subject to availability, blackout dates, and must be completed by December31, 2001. Approximate retail value: $4,500. Prize is non-transferable, for cash, or transferable and no substitution allowed except, at Sponsor's sole discretion, a prize of equal or greater value may be substituted if prior features are unavailable. No prize will be granted.

4. THE [illegible] sweepstakes begins October [illegible] and ends December 30, 2000. In [illegible] to or about January 1, 2001, to be conducted by an independent judge, [illegible] selection, fulfillment and all matters relating to the selection, [illegible] winners and remaining time or prize [illegible] certified. Odds of winning depend on the [illegible] of entries received.

6. ELIGIBILITY: Each entrant by entering this sweepstakes agrees (1) to be bound by these rules and the judge's decisions (2) that the entry becomes the Sponsor's property and will not be returned (3) that none of the Parties, nor any of their officers, directors, employees, agents or representatives (individually and collectively, "Parties") are responsible for claims, losses, losses or damages of any kind resulting from disqualification participation or the awarding, acceptance, use, misuse, possession, loss or misdirection of any prize (4) that the acceptance of a prize constitutes the grant of an unconditional right to use winner's name, address, voice, likeness, photograph, biographical and prior information and/or statements about the promotion for any publicity, advertising and promotional purposes without additional compensation, except where prohibited by law and (5) that the Parties have neither made nor are in any manner responsible or liable for any warranty, representation or guarantee, expressed or implied, in fact or in law, relative to any prize, including, but not limited to, its quality, mechanical condition or fitness.

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- Refrigerate or freeze leftovers within 2 hours
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the sink via an integral electric pump. Gray water goes down the drain and into a portable tank.

Two 12-volt gel-cell Exide batteries with an integral charger supply more than enough juice for a day's worth of TV, radio and refrigeration. A power inverter converts the batteries' DC to AC for the TVs. A control panel near the audio unit works it all.

The other end of the unit has compartments for folding chairs, snack tables, a second TV set, the satellite dish and a fire extinguisher.

We chucked the van's stock rubber in favor of a set of beefier 265/75R16 Goodyear Wrangler ATS tires on 16x8-in. alloy five-spoke wheels from Progressive Custom Wheels.

Sources

Air Lift (helper springs) P.O. Box 80167, Lansing, MI 48908 800-248-0892

Exide (batteries) 645 Penn St., Reading, PA 19612; 810-378-0500

Goodyear Tire & Rubber (tires) 1144 E. Market St., Akron, OH; 330-796-6827

Norcold (refrigerator) 600 Kuther Rd., Sidney, OH 45365; 937-498-6773

Pioneer Electronics (CD changer, radio and speakers) P.O. Box 1760, Long Beach, CA 90801; 800-421-1404

Progressive Custom Wheels (alloy wheels) 3100 Jefferson St., Riverside, CA 92504 800-726-5335

RCA/Thomson (satellite receiver and televisions) 10330 N. Meridian St. Indianapolis, IN 46290

U.S.S.B. (satellite service) 3415 University Ave., St. Paul, MN 55114; 612-645-4500

PHOTO BY DON CHADWICK

Our slide-in unit has storage space for remote controls, cooking utensils and condiments. The control panel directs power where needed. The entire unit sits securely on its steel cradle for easy storage and convenient loading.

What Would You Do?

Now, sit down and start thinking about what you would do. Write it all down and include some visual support—sketches, models, whatever. Then, we'll pick the one that we think's the best and give you the unit we've already built! PM

BUILD THE PERFECT TAILGATER OFFICIAL CONTEST RULES

Read these official rules before sending us your entry:

1. Your concept must be your own. That is, it must not have appeared in any magazine, book, newspaper, television, the Internet or any other media format.
2. Your idea must not infringe upon the rights of any third party.
3. Each entry must include the official printed coupon on this page. Except for entries from Maryland and Vermont, no copies or facsimiles of the entry form will be accepted.
4. Each entry must contain an essay of no more than 250 words explaining the ideas behind your personalized tailgater concept and an explanation of why the concept is novel, unique and/or superior.
5. The essay must include a physical description of your personalized tailgater concept, including the components and materials used, as well as their purpose.
6. Each entry must include a comprehensible sketch, painting, scale model, diorama or other depiction of your personalized tailgater concept.
7. All entries become the property of POPULAR MECHANICS. Each entry into the contest constitutes permission for The Hearst Corporation to use the entrant's name, photograph or other likeness, biographical information and essay for any advertising or promotional purpose without further compensation. The winner(s) further agrees to be photographed with various members of the POPULAR MECHANICS staff and consents to his and/or her name(s) and photographs being used in future issues of POPULAR MECHANICS and on the POPULAR MECHANICS magazine Web site.
8. Entry into the contest constitutes permission for POPULAR MECHANICS to have the winning projects professionally photographed at the owner's convenience for publication in POPULAR MECHANICS. POPULAR MECHANICS shall have the right to edit, adapt, modify or otherwise revise the winning entry for publication in the magazine in its sole discretion.
9. Entries will be judged for innovation, quality of ideas and suggested execution.
10. Judging will be performed by qualified staff members of POPULAR MECHANICS. The decision of the judges is final. No correspondence or telephone calls regarding the contest will be accepted by any POPULAR MECHANICS staff member. Please do not call or ask questions about the contest.
11. Entries should be mailed to POPULAR MECHANICS Perfect Tailgater Contest, 810 Seventh Ave., 6th Floor, New York, NY 10019.
12. The contest is open to anyone 18 years or older residing in any of the 50 United States of America, except employees of The Hearst Corporation and their families.
13. Entries must be received by February 28, 2001. Incomplete, late, illegible or misdirected entries will not be considered.
14. The winners will be notified by May 31, 2001, and will be asked to execute and return an affidavit of eligibility and release within thirty (30) days of attempted delivery of the same. Noncompliance within that same time period will result in disqualification and an alternate winner will be selected.
15. After the winners are notified, POPULAR MECHANICS will provide the winner's name to anyone. Send the request in writing along with a self-addressed stamped envelope to POPULAR MECHANICS, 810 Seventh Ave., 6th Floor, New York, NY 10019.
18. The contest is void where prohibited by law. All federal, state and local regulations apply.
17. One prize winner will receive the Tailgate unit pictured and described here. (Van and van modifications not included.) Delivery included. Prize may not be exchanged for cash or transferred. Any tax on the prize is the winner's sole reponsibility. Estimated prize value $10,000.

POPULAR MECHANICS Perfect Tailgater Contest
810 Seventh Ave., 6th Floor
New York, NY 10019

Name _____

Address _____

City _____ State _____ Zip _____

Phone (day) _____

(evening) _____

CHARGING HOME

Team PM makes a late-season surge for the cup.

BY AL PEARCE

Burton and the 99 Exide/POPULAR MECHANICS team will have to wait until next year to kiss the yard of bricks at Indy.

It didn't take long for the Brickyard 400 to become the No. 2 attraction on NASCAR's annual Winston Cup schedule. It settled there—behind the Daytona 500—almost as soon as Indianapolis Motor Speedway president Tony George and NASCAR president Bill France announced in 1993 that NASCAR finally would hold a race at the world's most famous speedway in 1994.

By the time of the inaugural Brickyard 400 in August 1994, almost every NASCAR driver was saying that other than the Daytona 500, Indy was the race he most wanted to win.

"The Daytona 500 is still the biggest race for most of us, but Indy has been the second-biggest since we started coming up here," said Jeff Burton of the Exide/POPULAR MECHANICS 99 Ford Taurus team.

MOTORSPORTS

"And it's not just the money. It's the prestige of the speedway and the tradition that goes with winning at the Indianapolis Motor Speedway. It's earning the right to go over to the start/finish line and get on your hands and knees with your crew and kiss that yard of bricks."

Burton, team owner Jack Roush and crew chief Frankie Stoddard will have to wait another year for their chance to kiss those bricks. After qualifying 33rd for the 160-lap, 400-mile race in August, Burton finished a strong sixth behind Bobby Labonte, Rusty Wallace, Bill Elliott, Jerry Nadeau and Tony Stewart. He earned $160,310 for his team and solidified his hold on fourth in the Winston Cup standings.

Even so, it was a bittersweet weekend. "We did the best we could, but we never really got a handle on the handling," Burton said after his second-best Brickyard 400 finish. "The important thing was that we started so far back. Our qualifying run was pretty ugly. We had a little push in practice and weren't able to get it out in time for qualifying. It just wouldn't stick in the turns, and that got us."

But Burton quickly headed toward the front in the 400. He moved to 29th on the first lap, was 23rd after just 10 laps and ninth after 20 laps. He was seventh at the halfway point, then briefly dropped to 18th while the field took pitstops between laps 115 and 120. He stormed back to seventh at lap 130, then moved into sixth for good at lap 140.

"We did all the right things," he said, "but we just couldn't ever get the car up front like we wanted. We were better in the final practice session than we were in the race. The weekend could have been better for the Exide/POPULAR MECHANICS team, but it could have been a lot worse, too."

The Brickyard 400 was the first in a string of 12 consecutive races that would take the teams into 10 states as they move from New Hampshire to Alabama, and from South Carolina to Michigan. The tour's next open date is Oct. 29—followed by consecutive races to close the season in Phoenix, Miami and Atlanta.

Barely five days after getting home from Indianapolis, the 99 team was on the road again. This time, it was to the historic road course at Watkins Glen, N.Y., for the Global Crossing@The Glen. Truth be told, few on the Exide/POPULAR MECHANICS 99 Ford Taurus team were looking forward to the 90-lap race at the famous circuit.

Burton, you see, isn't much of a road racer. He seems to truly embrace the challenge of turning left *and* right, shifting gears and braking, but has never finished better than ninth. His average finish in 13 career road races going into The Glen was 23rd. "My goal this year is to finish a road race better than my career best," he said at Watkins Glen. "There aren't many places

For More On Motorsports
Check the Automotive channel on the PMZone Web site at popularmechanics.com/auto

PHOTO BY GARRY ELLER/CAMERAS IN ACTION STOCK PHOTOGRAPHY

(Please turn to page 92)

FEEL LIKE

a kid again.

A **KID,** PILOTING A *Hellcat*
OVER THE **PACIFIC,** TRYING TO WIN
A **WORLD WAR.**

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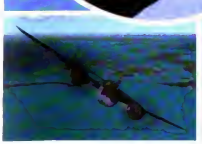

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to pass, so I need to qualify close to the front and keep it there for the whole race. I have something to prove this weekend."

He got a break when two days of rain forced NASCAR officials to set the 43-car grid by points and qualifying draw. That put Burton fourth on the grid, behind Bobby Labonte, Dale Jarrett and Dale Earnhardt. (Considering his qualifying woes, fourth was truly a godsend.)

Then Burton went out and raced like the devil. He quickly passed both Dales—Earnhardt and Jarrett—to settle into second behind Labonte. He muscled past Labonte to lead laps 9 through 23—it was only the second time in his career that he's ever led a road race. He remained in second, dropping back only briefly while pitstops took place, until Roush Racing teammate Mark Martin passed him at lap 80 in a futile attempt to catch leader Steve Park.

PHOTO BY ERNEST MASCHE/CAMERAS IN ACTION STOCK PHOTOGRAPHY

The Team Exide/Popular Mechanics Taurus leads the pack at The Glen.

PHOTO BY GARRY ELLIS/CAMERAS IN ACTION STOCK PHOTOGRAPHY

Burton proved he could turn right with the best of 'em after a career-best third-place finish at Watkins Glen.

Burton finished behind Park (a first-time Cup winner) and Martin, and ahead of fourth-place Robby Gordon and fifth-place Labonte. "The longer we ran, the tighter the car got and didn't want to turn," Burton said. "I tried all I could to hold off Mark for second, but I just couldn't do it. Even though I'm disappointed the car got tight, I'm still pretty pleased with third. This is my best-ever finish on a road course—by six spots. I need a little more time and experience on road courses to get it exactly right, but I'll take a top five any day. The best thing is that we finished ahead of all three guys ahead of me [Labonte, Jarrett and Earnhardt] in the points. I need to do that more often."

But he couldn't do it again in Michigan, and thus gave back everything he'd gained at Watkins Glen. Burton started 24th and finished 10th in the Pepsi 400 at the Michigan International Speedway. He left Michigan still fourth in points, 252 behind the leader, Labonte, and 15 behind Earnhardt. He had gone to Michigan 216 points out of first and two behind Earnhardt.

He put part of the blame for finishing 10th on tire strategy. The Exide/Popular Mechanics team took four tires under an early caution and quickly moved to seventh. Burton led for several laps after passing Labonte, and stayed near the front until the final 20 laps, when he dropped to 10th. It was his worst finish since early July, when he finished 11th in a rain-shortened race in New Hampshire.

"It's frustrating, and I'm really disappointed at the outcome today," Burton said. "We took two tires under caution (at lap 124), then two under green (at lap 170), and I guess that was a mistake. People who hadn't been as fast as me all day were getting past me near the end. Sometimes things like that happen."

Burton remains a solid championship contender, however. He has victories or career top five finishes at 11 of the season's last 12 venues (Talladega, Ala., is the exception), and fully expects to run well at all 12. "We can't afford any letdowns," he said at Michigan. "If we win races and finish top five, the points will take care of themselves. With good runs and a little luck, we can still win this thing." PM

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WITH AN ATTITUDE.

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Woodworking Guide

FURNITURE MAKING

4 Great ways to hide away your electronic gear when it's not being used:

- Computer Armoire
- Television Cabinet
- Stereo Case
- Tape And CD Storage Table

Cyber Secretary

A handsome cherry cabinet for your home office.

TEXT AND PHOTOS BY NEAL BARRETT

There's no question our electronic tools and toys have changed our lives—if only because there's so much new stuff filling our homes. The fact is, that big TV, the new sound system and the family computer can blend right in—it just takes a fresh look at the kind of furniture we build and use.

For example, back when the well-equipped family library was centered around a couple dozen volumes of an up-to-date encyclopedia, bookcases and shelves kept the desks and tables clear, while adding a touch of sophistication to the home. These days, with encyclopedias the size of paper-thin pancakes, you may think we've progressed. Perhaps so, in terms of information access. On the other hand, our new computers, printers, monitors and mice demand space of their own. And, unless you're happy giving up your dining room table to a humming and glowing network of wires and boxes, it's time to give the gear a place to call home.

COMPUTER ARMOIRE

To solve the problem, we've designed a dedicated computer cabinet with plenty of space for all the essentials, plus shelves for books, office accessories and things you just like to have around. To handle the paperwork, our case features a file drawer on full extension slides, and we've incorporated a locking pullout work surface that's perfect for a keyboard and mouse pad. The cabinet doors open 270° so you have full access to the interior of the case. We constructed our updated secretary out of a combination of solid cherry and cherry-veneered panels, but you can substitute another wood if it better suits your decor.

With frame-and-panel construction and classic crown molding, home computing never looked so good. Open each door a full 270° to reveal a pullout work area, shelves and file drawer (opposite).

Making Doors And Panels

Begin by ripping and crosscutting 1-in.-thick cherry to size for the stiles and rails of the doors and case sides. Lay out the rail and mortise locations on the stiles, clamping stiles of the same length together to ensure accuracy (Photo 1). Next, use a router edge guide and spiral bit to rout the mortises. To support the router, clamp two or three stiles together face to face. Register the guide on the outside face of each stile for consistant mortise locations. Then, rout the panel grooves in the edges of the stiles and rails (Photo 2), and square the mortises with a sharp ¾-in. chisel (Photo 3).

Equip your table saw with a dado blade to cut the rail tenons, and use a stopblock clamped to the miter gauge to position the rails (Photo 4). For the best glue joint, cut the tenons about ½ in. thicker than specified. After holding the rails on edge to cut the tenon shoulders, use a sharp chisel to pare the tenons to exact size.

We used ½-in. cherry-veneer MDF (medium-density fiberboard) for the panels. Although you can use cherry-veneer plywood instead, the stability and flatness of MDF make it a better choice. Cut the panels to size, and use a router table to shape the rabbet around the inside surface of each one (Photo 5). Sand each panel with 120-, 150-, 180- and 220-grit papers.

To assemble a frame, spread glue in the mortises and on all tenon surfaces. Then, join the rails to one of the stiles and slide the panel into position (Photo 6). Place the opposite stile in place and clamp the frame to pull the joints tight. Compare opposite diagonal measurements to be sure that the assembly is square, and let the glue cure. Proceed with the rest of the frames and doors in the same manner.

Panasonic

After cutting door and side-frame pieces to size, clamp together stiles of the same size and lay out the mortise locations.

Use a router and edge guide to cut mortises and panel grooves. Clamp together stock to provide a firm base for the router.

Inside The Cabinet

The inner case parts are constructed of veneer-core cherry panels. Rip and crosscut these parts about 1 in. oversize, and cut edge-banding strips from solid cherry to cover the exposed edges. Cut the strips about ⅛ in. wider than the thickness of the panels. Next, spread glue on a panel edge and clamp the strip so that it overhangs both faces of the panel. Scrape off the excess glue after about 20 minutes. When the glue has fully cured, plane the edge-banding strip flush. Then, cut the panels to finished dimension.

MATERIALS LIST—COMPUTER ARMOIRE

Key	No.	Size and description (use)
A1	4	1 × 3 × 48" cherry (upper case stile)
A2	4	1 × 3 × 31" cherry (lower case stile)
A3	4	1 × 3 × 44¼" cherry (upper door stile)
A4	4	1 × 3 × 23¼" cherry (lower door stile)
B1	6	1 × 3 × 19¼" cherry (case rail)
B2	4	1 × 5¾ × 19¼" cherry (case rail)
B3	8	1 × 2⅝ × 17⅞" cherry (door rail)
B4	2	1 × 3 × 17⅞" cherry (door rail)
C1	2	½ × 12 × 18¼" plywood (side panel)
C2	2	½ × 18¼ × 26" plywood (side panel)
C3	2	½ × 18¼ × 19" plywood (side panel)
C4	2	½ × 12 × 16⅝" plywood (door panel)
C5	2	½ × 16⅝ × 26" plywood (door panel)
C6	2	½ × 16⅝ × 19" plywood (door panel)
D	1	¾ × 23 × 46" plywood (upper top)
E1	2	¾ × 21½ × 46" plywood (shelf)
E2	2	¾ × ¾ × 46" cherry (edge band)
F1	3	¾ × 11 × 21½" plywood (upright)
F2	3	¾ × ¾ × 11" cherry (edge band)
G1	2	¾ × 21½ × 24" plywood (inner side)
G2	2	¾ × ¾ × 24" cherry (edge band)
H1*	1	¾ × 18¼ × 21½" plywood (drawer box top)
H2*	1	¾ × ¾ × 18¼" cherry (edge band)
I1	1	¾ × 12 × 21½" plywood (drawer box side)
I2	1	¾ × ¾ × 12" cherry (edge band)
J1	2	¾ × 4½ × 44½" plywood (stretcher)
J2	1	¾ × 4½ × 44½" plywood (stretcher)
J3	1	¾ × ¾ × 44½" cherry (edge band)
K1	2	¾ × 16½ × 41¾" plywood (work surface)
K2	2	¾ × 1 × 42¼" cherry (edge band)
K3	2	¾ × 1 × 16⅝" cherry (edge band)
L1	1	¾ × 22¾ × 46" plywood (lower bottom)
L2	1	¾ × 2 × 46" cherry (edge band)
M	1	¾ × 24¾ × 47⅝" plywood (lower back)
N1	1	¾ × 7 × 49¼" cherry (base)
N2	2	¾ × 7 × 24" cherry (base)
O1	1	¾ × 23¼ × 48" plywood (desktop)
O2	1	¾ × 4 × 48" plywood (spacer)
O3	1	¾ × 4 × 40" plywood (spacer)
O4	2	¾ × 4 × 19¼ plywood (spacer)
O5	1	¾ × 4 × 15¼" plywood (spacer)
O6	1	¾ × 1 × 49¼" cherry (edge molding)
O7	2	¾ × 1 × 24" cherry (edge molding)
P1	1	¾ × 3 × 49" cherry (molding)
P2	2	¾ × 3 × 23⅝" cherry (molding)
Q*	1	¾ × 26 × 53⅜" plywood (case top)
R1	1	2 × 2 × 53" cherry (cove molding)
R2	2	2 × 2 × 25⅛" cherry (cove molding)
S1	2	1 × 1¾ × 44¼" cherry (hinged stile)
S2	2	1 × 1¾ × 23¼" cherry (hinged stile)
T	1	¾ × 47¾ × 48¼" plywood (upper back)
U1	2	¾ × 10¾ × 18" plywood (drawer side)
U2	1	¾ × 10¾ × 16¼" plywood (drawer front)
U3	1	½ × 9¾ × 16¼" plywood (drawer back)
U4	1	¾ × 16¼ × 16¼" plywood (bottom)
U5*	1	¾ × 11¼ × 17¼" plywood (drawer face)
V	2	¾ × ¾ × 16⅝" aluminum (file hanger)
W	as reqd.	veneer tape
X1	"	No. 20 plate
X2	"	No. 0 plate
Y1	"	¾" No. 6 rh woodscrew
Y2	"	1" No. 8 rh woodscrew
Y3	"	1½" No. 8 fh woodscrew
Y4	"	2" No. 8 fh woodscrew
Z1	"	1" brad
Z2	"	3d finishing nails
Z3	"	4d finishing nails
Z4	"	6d finishing nails
AA**	1	pair 18" shelf slides (Accuride 340-18)
BB**	1	pair 18" drawer slides (Accuride 3037-18)
CC†	1	ring pull
DD††	20	1⅛ × 2¼" hinge
EE††	4	1¾"-dia. cherry knob
FF‡	1	grommet
GG		magnetic catch

Misc.: Ogee bit (Bosch No. 85271M); 30° chamfer bit (No. 160-325), available from Wesley Tools Ltd., **346 Maple Ave., Westbury, NY 11590; glue; 120-, 150-, 180- and 220-grit sandpaper; tack cloth; 4/0** steel wool; Waterlox Original Sealer/Finish (Waterlox Coatings Corp., 9800 Meech Ave., Cleveland, OH 44105).

* Dimension includes veneer tape.

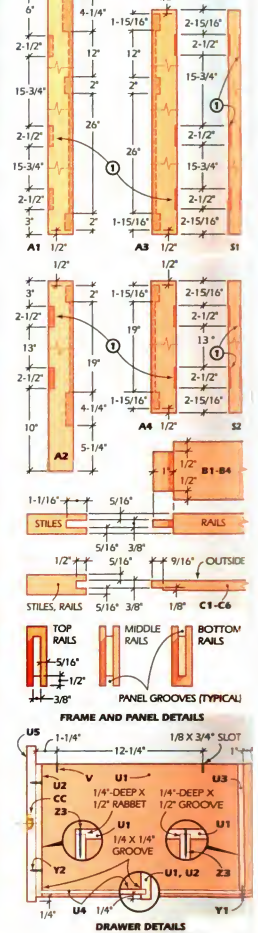
** Available from **Dave Sanders and Co., 100 Cleveland Ave., Freeport, NY 11520.**

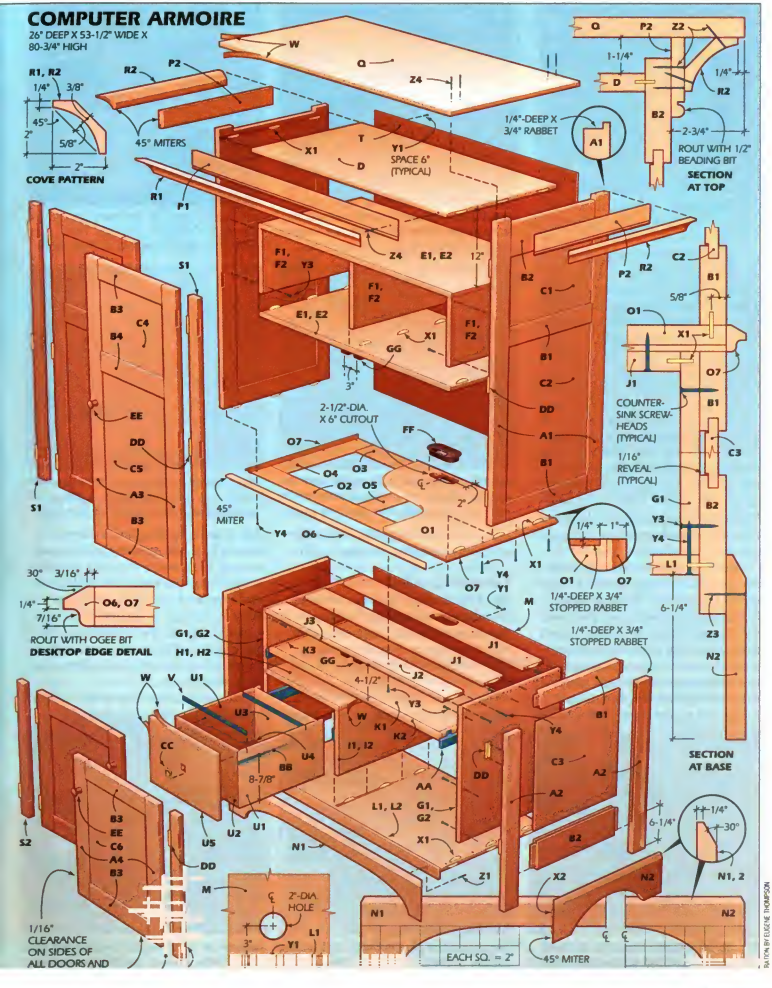
† Ring pull (No. 0392-030) manufactured by Baldwin, 841 E. Wyomissing Blvd., Box 15048, Reading, PA., 19612.

†† Knob (No. 75KW71) and hinge (No. 107H40) available from Whitechapel Ltd., P.O. Box 136, Wilson, WY 83014; 800-468-5534.

‡ Grommet (No. 91380) available from Rockler Woodworking and Hardware, 4365 Willow Dr., Medina, MN, 55348; 800-279-4441.

Note: All plywood cherry veneer, MDF-core stock preferred for door and side panels.




COMPUTER ARMOIRE
26" DEEP X 53-1/2" WIDE X 80-3/4" HIGH
COVE PATTERN
45° MITERS
1/4"-DEEP X 3/4" RABBET
ROUT WITH 1/2" BEADING BIT
SECTION AT TOP
COUNTER-SINK SCREW-HEADS (TYPICAL)
1/16" REVEAL (TYPICAL)
1/4"-DEEP X 3/4" STOPPED RABBET
SECTION AT BASE
2-1/2"-DIA. X 6" CUTOUT
45° MITER
ROUT WITH OGEE BIT
DESKTOP EDGE DETAIL
1/4"-DEEP X 3/4" STOPPED RABBET
2"-DIA. HOLE
1/16" CLEARANCE ON SIDES OF ALL DOORS AND
EACH SQ. = 2"
45° MITER
RAYTON BY EUGENE THOMPSON

Lay out the joining-plate locations for the upper case shelf assembly and cut the slots (Photo 7). Apply glue, join the uprights to the shelves and clamp.

To construct the lower case insert, first apply veneer tape to the exposed edge of the drawer enclosure top as shown in the plan. Use a household iron to apply the tape and trim the excess with a chisel. Lay out and cut the plate slots, then glue the drawer-box top and side together. Cut plate slots for joining the drawer box to the left side of the inner case and install plates without glue to align the parts. Secure the subassembly with screws (Photo 8). Then, assemble both inner sides with the stretchers using dry joining plates and screws (Photo 9).

Outer Case Work

It's easiest to cut the hinge mortises in the case side frames before assembling the cases. Use a marking gauge and square to mark the outline of each mortise. Then, make a series of parallel chisel cuts along the mortise just shy of the finished depth (Photo 10). Hold the chisel horizontally to pare away the waste (Photo 11), and test fit each hinge to see that it sits flush.

Use your router and edge guide to cut the rabbet along the back edges of the side frames. Note that each lower case side has a stopped rabbet. Stop the cut about ¼ in. short and square the end with a chisel.

Next, cut the joining-plate slots in the lower case side frames and lower bottom panel. Apply glue to these joints and assemble the sides to the panel. Clamp the parts and set the assembly aside for the glue to cure.

3

After the grooves are cut, use a sharp ¾-in.-wide chisel to square the ends of each mortise in the side and door stiles.

4

Use a dado blade in the table saw to cut the tenons slightly oversize. Then, pare them to the exact size with a sharp chisel.

5

Mount a straight bit in the router table and cut the rabbets on the back sides of the side and door panels. Then sand the panels.

6

Apply glue to mortises and tenons and join rails to one stile. Slide panel in place, add remaining stile and clamp until glue sets.

Lower Case Assembly

Place the lower case insert between the sides, using joining plates to hold the drawer-box side in position on the case bottom. Install clamps to keep the insert from shifting. Bore and countersink pilot holes, and fasten the insert subassembly to the sides and bottom with screws (Photo 12). Cut the back panel to size and bore a 2-in.-dia. hole for power cord access. Next, screw the back in place.

Rip ¾-in.-thick stock to width for the base and cut it to length with 45° miter joints at the front corners. Cut No. 0 joining-plate slots in the miter joints (Photo 13). Lay out the curved profiles and use a sabre saw to make the cuts.

Mount a chamfer bit in the router table to shape the top edge of the

7

Cut the plate slots in case parts. Clamp a straightedge to each upper case shelf to position slots for center partition.

8

Use plates and glue to build the L-shaped section of the drawer box. Use dry plates and screws to attach to inner case side.

9

Secure the top stretchers to the lower case sides with screws. Joining plates hold parts in alignment while fastening.

base pieces. Then, glue together the three base pieces using clamps to pull the miters tight. Fasten the base to the lower case with 6d finishing nails and 1-in. brads. Bore pilot holes for the nails.

Upper Case

Cut a panel to size for the desk surface, and glue ¼-in. spacers to the underside as shown in the drawing (Photo 14).

Glue mitered edge-banding strips to the desktop front and side edges (Photo 15). Plane the edging flush, and rout the edge profile. Cut the bottom part of the molding with an ogee bit, and bevel the top of the profile with a 30° chamfer bit.

Mark the position of the wire grommet in the desktop, bore holes and use a sabre saw to make the cutout. Then, rout the stopped rabbet along the back edge of the desktop and square the ends with a sharp chisel.

Lay out and cut the joining-plate slots for the upper case assembly and bore pilot holes for screwing the desktop to the sides. Apply glue to the plates and slots to join the case top and sides and assemble these parts with clamps. Place dry plates in the desktop slots, and join the desktop to the sides with screws (Photo 16).

Use a beading bit to rout strips of ½-in.-thick cherry for the upper case molding. Miter the strips to length, and install them with 3d finishing nails. Cut the case upper top to size and apply veneer tape to the exposed edges. Fasten the upper top panel to the side-frame stiles and beaded molding with 6d finishing nails.

We shaped the cove molding on a table saw with a standard 10-in.-dia. blade. While not unusual, this technique requires special care and the operation must be carried out cautiously. If you are not comfortable with the procedure, purchase appropriate molding from your lumber dealer.

To make the cove molding, first rip 1-in. stock to a width of 4 in., and cut each piece several inches longer than finished dimension. Next, set your miter gauge to 38° and use it to position a long wooden fence across the saw table at that angle. With the blade height at ¾ in., move the fence so that it's

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10

Use a chisel to outline each mortise. Then, make a series of cuts across the grain and about ¼ in. apart within the waste area.

11

Hold the chisel horizontally to pare away the waste in each hinge mortise. Test the fit of each hinge and adjust as required.

12

Slide the inner case into position between the lower case outside frames, and clamp. Screw the inner sides to the outer frames.

13

Cut the base pieces to finished length with mitered ends. Use joining plates in the miters to help hold the joints tight.

14

Build up the bottom edges of the desktop by gluing ¼-in.-thick spacers to the panel. Keep the strips flush with the panel edges.

15

Glue solid edging to the desktop panel. Let the edging overhang the panel faces, and plane it flush after the glue sets.

16

After using glue and plates to join the top to the side frames, position the desktop at the bottom of the sides and screw it in place.

Use a wooden fence angled across the saw table to guide the stock for a cove cut. Increase blade height in 1/16-in. increments.

$1\frac{3}{16}$ in. from the front edge of the blade and clamp it to the table. Mount a featherboard to the table to hold the work against the fence. Set the saw blade to a height of 1/16 in. and use pushsticks to move the stock across the spinning blade (Photo 17). Raise the blade 1/16 in. for the next pass, and continue until the cove depth is reached. Then, remove the wooden fence and set the blade to 45° to rip the face and back angles

Assemble the drawer box using glue and 6d finishing nails. Note 1/2 × 3/4-in. slots in the drawer sides for hanging-file guides.

Cut a mortise in the drawer face for the ring pull. A 1-in.-dia. recess in the center of the mortise fits the body of the pull.

Use a goosneck scraper to remove saw marks from the face of the cove molding. Then, sand with 220-grit sandpaper.

of the molding. Finish by smoothing with a gooseneck scraper and 220-grit sandpaper (Photo 18). Use a miter saw to cut the cove molding to length, and nail it to the top of the upper case as shown.

Final Steps

Mount the hinges in the case sides and cut the hinged stiles to size. Clamp a hinged stile against one of the case sides with a 1/16-in. shim under its bottom end. Use a knife to transfer the hinge locations to the edge of the stile. Then, lay out the hinge mortises along both edges of the hinged stile. Repeat the process for each stile, cut the mortises and mount the stiles to the sides.

Install the back panel of the top case with 3/4-in. No. 6 screws. After fastening hinges to the open side of the hinged stiles, transfer the mortise locations to the cabinet doors. Mount the doors to the case and trim them as necessary to achieve a uniform margin of 1/16 in. Install the doorknobs and magnetic catches.

To install the pullout work surface, install support clips on the panel edges and attach the panel to the side-mounted slides.

Cut the drawer stock to finished sizes. Use a dado blade in the table saw to cut the rabbet and dado in each side. Cut the grooves for the drawer bottom. Make slots in the top edge of the sides for the hanging-file rails. Use glue and 6d finishing nails to assemble the drawer box (Photo 19). Slide the bottom into place and screw it to the drawer back.

Cut the drawer face from 3/4-in. cherry plywood and apply veneer tape to the four edges. Mark the location of the flush pull on the drawer face, and cut a recess to house the pull. Mount the pull to the face with screws (Photo 20), and screw the drawer face to the front of the drawer. Cut pieces of 1/4 × 3/4-in. aluminum bar for the hanging-file rails, and use a dab of epoxy to secure them to the drawer.

Mount the drawer slides on the case and drawer. For initial installation, use only the slotted holes to allow for adjustment. Once the drawer operates smoothly, install the rest of the screws.

Cut a panel for the pullout work surface and apply edge banding. Mount the slide to the inner case sides and mount the clips to the work surface ends (Photo 21). Install the work surface in the case, checking for smooth operation.

Cut the wire-grommet hole in the lower case rear stretcher, and position the upper case on the lower case. Bore and countersink pilot holes through the lower case stretchers into the bottom of the desktop, and drive screws to fasten together the sections.

Disassemble the case and remove the hardware for finishing. Set all nailheads, and fill the holes. Sand all surfaces with 120-, 150-, 180- and 220-grit paper, dusting between grits. Use a tack cloth to wipe all surfaces before applying any finish.

We finished our cabinet with three coats of Waterlox Original Sealer/Finish. Use a brush or rag to spread a liberal coat, let it sit for 10 to 15 minutes and wipe off the excess. Let the finish dry overnight, and repeat the process for each coat. When the final coat is dry, burnish the surface with 4/0 steel wool and polish it with a soft cloth. PM

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WB3020

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Open For Viewing

A handsome home for your TV and VCR.

TEXT AND PHOTOS BY NEAL BARRETT

Remember the old console

TVs? Mounted in wooden cabinets, those early sets were as much furniture as new technology. The designers knew, or at least thought, that no one would want the naked machine in their home. After all, it just didn't match anything else. In fact, many of the TV cabinets had doors to keep the tube tastefully under wraps until the family's favorite weekly show came on.

Well, everything old is really new again—only with a twist. After living with plastic TVs and vestigial wood-grain accents for the last several decades, we're all ready to reincorporate The Box into the design scheme of our homes. TV cabinetwork is finally back—only now we do it ourselves.

A television cabinet, though, does more than just keep the interior decorator of the house happy. With most sets wired to a VCR at least, the modern household needs a central location for everything—including a place to hide the wires and store videotapes. Plus, an independent cabinet means we're not wedded to this year's TV when next year's model looks too good to pass up.

TV CABINET

We designed our TV cabinet with enough room for a typical 27-in. set. There's a shelf for a VCR and cable or satellite box, and two roomy drawers for tapes and DVDs. The full-width front doors on the cabinet are mounted on retractable slides that allow the doors to slip back into the case sides for unobstructed viewing.

We constructed our cabinet out of a combination of solid maple and maple-veneer panels. The case sides, shelves and back are made from veneer-core panels, while we used flat, stable MDF (medium-density fiberboard) stock with maple veneers for the door panels. The doorframes and the 1¾-in.-thick case top are made from solid maple stock.

With the doors closed, our TV cabinet blends into any decor. Open (opposite page), the doors hide inside to provide a clear view of the screen. Shelves and drawers accommodate DVDs, tapes and accessories.

The Case Panels

Begin by cutting ¾-in. panels to rough size for the case sides, shelves, drawer partition and insert-case parts. Rip maple edge-banding strips from 13/16-in. maple, and glue the strips to the front edges of the case sides, drawer partition and insert panels. Center the strips so they protrude beyond the panel faces an equal amount on both sides.

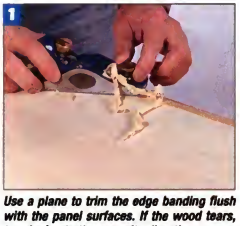
Let the glue set for about 20 minutes, then scrape off any excess. When the glue is dry, use a block plane to trim the strips flush with the faces (Photo 1). Then, cut the panels to exact size.

Install edge banding on the case bottom ends and front edge, using miter joints at the corners (Photo 2), and plane the strips flush. Do not edge-band the middle shelf at this time. The edge molding for that shelf will be applied after you've assembled the case.

Make the 24¾-in.-wide maple top by gluing up several narrow pieces of stock. Cut each piece an inch or two longer than finished dimension and joint the mating edges. While simple glued butt joints are fine, joining plates help align the pieces during assembly. After cutting the slots (Photo 3), spread glue, install the plates and clamp the boards. Scrape off excess glue after about 20 minutes. When the glue has fully cured, use a circular saw and straightedge guide to cut the panel to size.

Case Assembly

Lay out the joining plate positions for the case panels and cut the slots. For slots in a panel face, use a



Use a plane to trim the edge banding flush with the panel surfaces. If the wood tears, try planing in the opposite direction.

Cut the case bottom panel to finished size. Glue mitered edge-banding strips to the front and both ends of the panel.

Glue up solid maple stock to form the case top. Joining plates in mating surfaces help keep pieces aligned during assembly.

Cut joining-plate slots in case parts. Clamp a guide across the panels to help position the joiner for slots in the panel faces.

Use a straight bit and edge guide to rout the rabbets along the back edges of the case sides and the top and bottom panels.

Use a ¼-in.-rad. rounding-over bit to shape the bottom edge of the case top. Rout a 30° chamfer around the top edge.

straightedge guide to position the plate joiner (Photo 4).

Use a router with a straight bit and edge guide to cut the rabbets along the back edges of the case sides (Photo 5). Note that the rabbets for the top and bottom panels stop short of the panel ends. Use a sharp chisel to square the rabbet ends after they've been routed.

Rout the edge profile on the case top in two steps. First, use a ⅜-in.-rad. rounding-over bit to cut the profile along the bottom edge of the top panel (Photo 6). Then, turn the panel over and use a 30° chamfer bit to cut the top profile.

Use a ¼-in. cove bit to rout the edge band on the case bottom edge. Adjust the depth of the bit so it makes only a ⅛-in.-deep cut, and test the cut on a piece of scrap stock before moving on to the actual piece.

Use the same bit in the router table to cut the molding for the middle shelf and case sides. Start with a maple blank about 48 in. long, 4 in. wide and ¾ in. thick. Rout both corners of one edge of the blank, and use a table saw to rip the molding from the blank.

Join the drawer partition to the middle shelf with joining plates and screws (Photo 7). Because this joint is hidden, use plates to align the parts and use screws instead of glue. Clamp the parts together while you bore pilot holes for 2-in. No. 8 screws and drive the screws.

MATERIALS LIST—TV CABINET

Key	No.	Size and description (use)
A1	2	¾ × 25¾ × 38¾" plywood (case side)
A2	2	¾ × ¾ × 25¾" maple (edge band)
B1	1	¾ × 5¼ × 22¼" plywood (partition)
B2	1	¾ × ¾ × 5¼" maple (edge band)
C1	3	¾ × 22¼ × 36" plywood (insert shelf)
C2	3	¾ × ¾ × 36" maple (edge band)
C3	2	¾ × 22¼ × 32¼" plywood (insert side)
C4	2	¾ × ¾ × 32¼" maple (edge band)
D1	1	¾ × 24 × 43¼" plywood (case bottom)
D2	2	¾ × ¾ × 24¾" maple (edge band)
D3	1	¾ × ¾ × 44¼" maple (edge band)
E	1	¾ × 23¾ × 42" plywood (middle shelf)
F1	2	¾ × ¾ × 24¾" maple (molding)
F2	1	¾ × ¾ × 44¼" maple (molding)
G*	1	1¾ × 24¾ × 45" maple (top)
H	8	1 × 3¼ × 4" plywood (leg)
I1	2	¾ × 1¾ × 42¼" maple (base rail)
I2	2	¾ × 1¾ × 23" maple (base rail)
J	1	½ × 39¾ × 43" plywood (back)
K	4	15/16 × 4 × 32¼" maple (stile)
L	4	15/16 × 5¾ × 14 13/16" maple (rail)
M	2	15/16 × 2 13/16 × 24" maple (mullion)
N	8	15/16 × 2 × 7" maple (short rail)
O	12	½ × 6 × 7" plywood (door panel)
P	4	½ × 4¾ × 22¼" maple (drawer side)
Q	2	½ × 4¾ × 19¾" maple (drawer front)
R	2	¼ × 19¾ × 21¼" plywood (bottom)
S	2	½ × 4¾ × 19¾" maple (drawer back)
T	2	15/16 × 5¾ × 20 9/16" maple (drawer face)
U**	2	pair 22" drawer slides (Accuride No. 3832-22)
V**	2	pocket door hardware
W†	4	knob
X1	as reqd.	1" brad
X2	"	4d finishing nail
Y1	"	¾" No. 6 rh woodscrew
Y2	"	1" No. 6 rh woodscrew
Y3	"	1" No. 8 fh woodscrew
Y4	"	1¼" No. 8 fh woodscrew
Y5	"	2" No. 8 fh woodscrew
Y6	"	2¼" No. 8 fh woodscrew
Z1	"	No. 0 joining plate
Z2	"	No. 20 joining plate

Misc.: 30° chamfer bit (No. 160-325), Wesley Tools Ltd., 346 Maple Ave., Westbury, NY 11590; glue; 120-, 150-, 180- and 220-grit sandpaper; tack cloth; 4/0 steel wool; Behlen Water White Restoration Varnish (No. 849-328), Woodworker's Supply, 1108 N. Glenn Rd., Casper, WY 82601; 800-645-9292.

* Laminate from narrower stock.

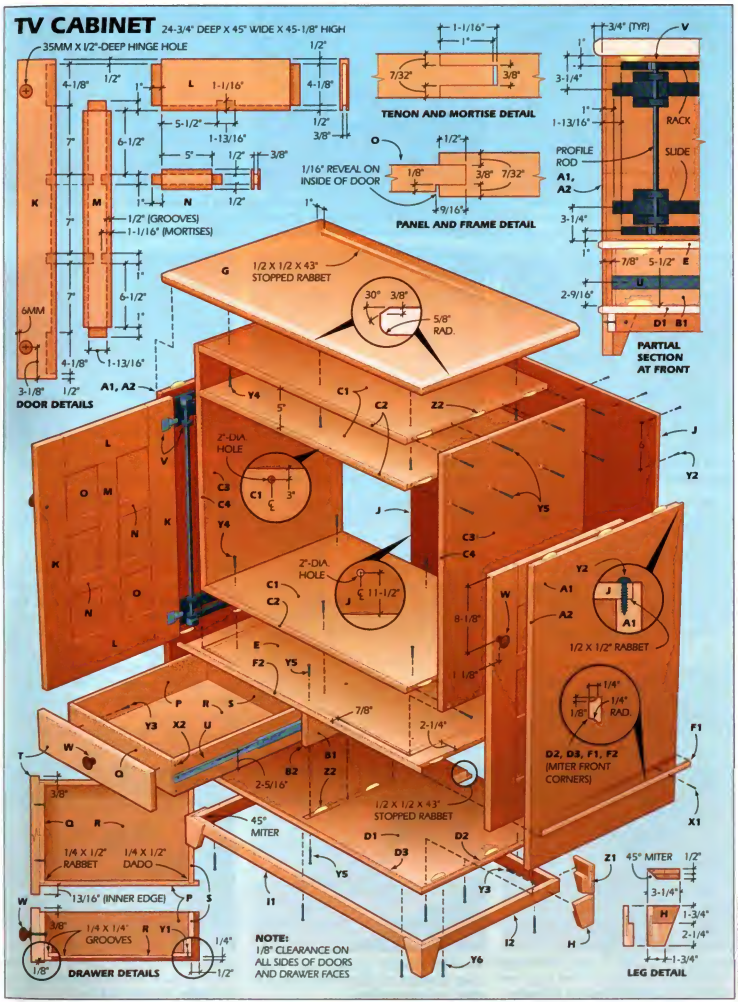
** Pocket door hardware (No. 31131) and drawer slides (No. 32516) available from Rockler Woodworking and Hardware, 4365 Willow Dr., Medina, MN 55348.

† Knob (No. 74RE4) available from Whitechapel Ltd., P.O. Box 136, Wilson, WY 83014; 800-468-5534.

Note: MDF-core stock preferred for door panels.

TV CABINET

24-3/4" DEEP X 45" WIDE X 45-1/8" HIGH



Because screwheads will be hidden, use screws to join the partition to the case's middle shelf. Plates keep parts aligned.

Glue the case sides to the middle shelf. A caul with a thin veneer shim at the center distributes pressure across the panel.

Use a combination of joining plates and screws to fasten the case bottom to the sides and drawer partition.

Use glue and 1-in. brads to fasten molding to the case sides. Set the nailheads and fill with a matching, sandable wood filler.

Use a clamp to hold the leg blanks to the table saw miter gauge when cutting the rabbet along the top inside surface.

After cutting the base rails to size with mitered ends, use screws and glue to fasten the rails to the mitered legs.

Next, spread glue in the plate slots to join the case sides with the middle shelf and assemble. Use cauls to distribute the clamping pressure (Photo 8). Apply glue to the slots to join the top and sides, position the top and use clamps to pull the joints tight.

Bore and countersink screwholes in the case bottom, and pilot holes in the case sides and drawer partition. Then, install joining plates and screw together the parts (Photo 9).

Miter the molding to length for the middle shelf and case sides. Spread glue on the shelf strip and clamp it in place. Install the side strips using glue and 1-in. brads (Photo 10). Now you're ready to set the nailheads and fill.

Making The Base

Cut 4-in.-sq. leg blocks of 1-in. maple, with one edge of each parallel to the grain beveled to 45°. Cut a No. 0 plate joint slot in the beveled edge. Next, use a dado blade in the table saw to shape the rabbet at the top inside edge of each leg block (Photo 11).

Spread glue on the beveled edges and plate slots, insert the plates and assemble the legs. When the glue has dried, make the angled cuts to taper each leg.

Cut the base rails to size with mitered ends. Glue and screw the rails to the legs (Photo 12). Bore and countersink pilot holes for attaching the rails to the case, and then install the base.

Cut the case back from a sheet of ½-in.-thick plywood. Mark the location of the 2-in.-dia. cord-access hole in the back panel and bore the hole with a multispur or Forstner bit. Then, mount the back to the case with 1-in. No. 6 screws.

Rout the mortises in the doorframe components. Clamping stiles together provides an extra-wide base for the router.

When the routing is done, use a sharp chisel to square the ends of the mortises in stiles, mullions and rails.

Adjust the router bit cutting depth and shape the panel grooves in the edges of the door stiles, rails and mullions.

(Please turn to page 110)

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16

Use a dado blade in the table saw to cut the rail and mullion tenons. A stop clamped to the miter gauge positions the work.

Door Construction

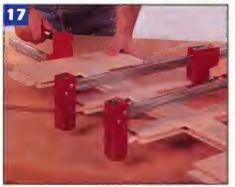
For all door parts, rip and crosscut 13/16-in.-thick maple to size. Lay out the joints and use a router with a spiral up-cutting bit and edge guide to cut the mortises. Clamp the stiles together to form a wide, stable base for the router, and cut the four mortises in each stile (Photo 13). Next, cut the mortises in the top and bottom rails and mullions. Use a sharp chisel to square the rounded ends of each mortise (Photo 14). Then, rout the panel grooves in the edges of stiles, rails and mullions (Photo 15).

18

Screw the pinion-wheel/mounting-block assembly to the door slide. Detailed instructions are included with the hardware.

19

Bore 35mm-dia. recesses in the door stiles for the hinge cups. Then, install the hinges to the doors and adjust for proper operation.



17

After joining short rails to the mullion, apply glue and clamp the rails in place. Then install panels and stiles.

Use a dado blade in the table saw to cut the tenons on the rails and mullions. First, cut the tenon cheeks (Photo 16), and then readjust the blade height to cut the shoulder at the outside edge of the top and bottom rails. Clamp the short rails to the miter gauge so your hands stay safely away from the blade.

Cut the door panels to size and use a straight bit in the router table to shape the rabbet around the inside edges of each panel. Sand the panels with 120-, 150-, 180- and 220-grit paper before beginning the door assembly.

Spread glue in mullion mortises and corresponding short rail tenons, assemble these parts and clamp. Next, spread glue on the mullion tenons and top and bottom rail mortises and join (Photo 17). When the glue has set, slide the panels into the grooves. Then, spread glue on the rest of the joints, add the stiles and clamp.

Study the instructions included with the door hardware so that you understand the operation of the slide before beginning the installation. Secure the door slides to the inside of the cabinet sides. Cut small spacer blocks to help position the slides accurately from the case top and bottom and parallel to each other. Next, attach the rack drives to the case sides. Secure the pinion wheels and mounting hardware to the profile rods as shown in the slide instructions. Mount the rod assembly on the slides (Photo 18) and fasten the mounting plates.

Use a Forstner or multispur bit in a drill press to bore a 35mm-dia. × ½-in.-deep recess in the doors for each hinge. Install the hinges (Photo 19) and mount the doors on the slides. Use the mounting-plate screws to adjust the doors for proper operation and a uniform ⅛-in. margin.

20

After assembling the case insert, bore pilot holes and fasten it to the cabinet top and middle shelf with screws.

Final Steps

Bore the 2-in.-dia. wire-access hole in the insert shelf. After assembling the case insert with joining plates and screws, slide the insert into the cabinet, bore and countersink pilot holes, and secure the insert to the cabinet top and middle shelf with screws (Photo 20).

Cut ½-in. maple to size for the drawer parts. Use a dado blade to make the rabbet and dado joints in the drawer sides and the grooves for drawer bottoms. Assemble the drawer boxes with glue and 4d finishing nails.

Cut bottom panels from ¼-in. maple plywood, slide them in place and screw each to a drawer back. Cut drawer faces from 13/16-in. stock, and screw them to the drawers. Mount the drawer slides following the manufacturers instructions. Bore pilot holes for the door and drawer knobs but don't install them until the case is finished.

Disassemble the case and remove the hardware for finishing.

Sand all case parts to 220 grit, dusting carefully between grits. Wipe all surfaces with a tack cloth before applying the first coat of finish. We applied three coats of Behlen's Water White Restoration Varnish, following the manufacturer's instructions. When the last coat is dry, buff the finish with 4/0 steel wool and polish it with a soft cloth. Finally, reassemble the case and install the doors, drawers and hardware. PM

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Surround Sound

Furniture for your stereo.

TEXT AND PHOTOS BY NEAL BARRETT

There is a staggering variety of stereo systems available today, and depending on your finances and your level of enthusiasm in these matters, you can spend hundreds or thousands of dollars on equipment. For serious audiophiles, the sleek, black cases of stacked stereo components are the only way to go. But most of us would rather shut the works behind closed doors and concentrate on the music.

Our Arts & Crafts style cabinet is a perfect home for a basic stereo system. It easily accommodates a receiver, CD and tape players. And although high-technology audio components are the preferred means for many people to play music today, we kept in mind that many others are loathe to give up their vinyl collections. For that reason we have provided space for a turntable on top and a shelf for a modest LP collection as well. There are also two drawers, one for tapes and one for CDs. In keeping with traditional Arts & Crafts pieces, we used quarter-sawn white oak for the cabinet. If you have trouble locating quarter-sawn oak where you live, one mail-order supplier is Talarico Hardwoods, RD 3, Box 3268, Mohnton, PA 19540; 610-775-0400.

STEREO CABINET

Our cabinet stores modern stereo components neatly out of sight. With the door shut, it looks like a traditional Arts & Crafts hutch.

Building The Case

Rip and crosscut stock for the case rails and shelves, but leave each workpiece a bit oversize, so you can trim the glued-together panels to finished dimension after the glue has set. Joint the edge of each workpiece straight and square, and lay out the joining-plate slots spaced approximately 6 in. on center.

Hold the plate joiner and the workpiece tightly to the surface of the workbench, and cut the slots (Photo 1).

Spread glue in the slots, along the edges of the workpieces and on the joining plates (Photo 2). Position the plates and assemble a panel. Clamp the panel to pull the joints tight, then check that the panel is flat.

Next, glue up the ½-in.-thick stock for the side and door panels. It's not a good idea to use joining plates to align the joints on these thinner panels because the plate joint may be visible after the panel is finished.

Prepare the rest of the stock for the case parts. Rip, crosscut and joint all parts to finished dimension, including the previously glued-up panels. Label each part to indicate the face side and orientation in the case.

Lay out the mortises in the case side stiles by clamping the stiles together, then mark across their edges (Photo 3). Use a plunge router with a ½-in.-dia. up-cutting bit and an edge guide to cut the mortises (Photo 4). Clamp two stiles together before routing to provide a stable surface for the router, and cut the mortise in two or three passes.

While you have the router out, readjust its depth of cut, and cut the panel grooves in the stile edges. Readjust the router again to cut the panel grooves in the side rails, and then chop the ends of the mortises square using a chisel (Photo 5).

Install dado blades in the table saw and cut the tenons on the side rails. Since the rails are quite wide, the tenons are divided into two separate pieces. Begin by cutting one wide tenon on each end of the rails (Photo 6). Cut the tenons slightly oversize, and then pare them smooth with a razor-sharp chisel. Divide each tenon into two sections by making a rectangular cutout in the center using a handsaw and chisel.

Next, set the table saw blade to cut a 45° bevel, and cut the chamfered ends on the side stiles (Photo 7). Use the miter gauge to guide the work.

Test fit the joints for each case side and make adjustments as necessary. Sand the side panels with 120-, 150-, 180- and 220-grit sandpaper before assembly.

To assemble a cabinet side, spread glue in the stile

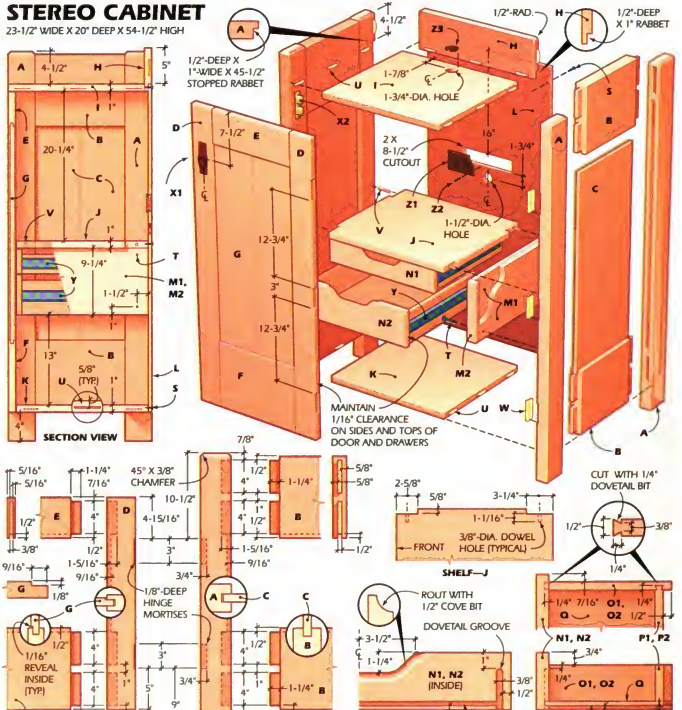
Cut joining-plate slots in the boards' edges. The plates keep the boards aligned while they are being glued and clamped.

To ensure a properly bonded joint, apply glue to the joining-plate slots, the board edges and the joining plates.

Lay out the mortises in the case stiles by clamping the workpieces together, and mark across them using a square.

STEREO CABINET

23-1/2" WIDE X 20" DEEP X 54-1/2" HIGH



MATERIALS LIST—STEREO CABINET

Key	No.	Size and description (use)
A	4	1¾ × 3¾ × 54" white oak (stile)
B	4	1¾ × 10 × 15" white oak (rail)
C	2	¾ × 13¾ × 30¾" white oak (panel)
D	2	1 × 3¾ × 44⅝" white oak (stile)
E	1	1 × 4⅝ × 15⅛" white oak (rail)
F	1	1 × 10 × 15⅛" white oak (rail)
G	1	¾ × 14 × 30¾" white oak (panel)
H	1	1 × 6 × 20" white oak (rail)
I	1	1 × 19 × 20" white oak (shelf)
J	1	1 × 18¾ × 21¼" white oak (shelf)
K	1	1 × 18¾ × 20" white oak (shelf)
L	1	¾ × 22 × 45½" plywood (back)
M1	2	¾ × 9¼ × 17¾" plywood (blocking)
M2	2	¾ × 1 × 9¼" white oak (edge band)
N1	1	¾ × 3½ × 18¾" oak (drawer face)
N2	1	¾ × 5 × 18¾" oak (drawer face)
O1	2	¾ × 2¾ × 16¾" maple (drawer side)
O2	2	¾ × 4¾ × 16¾" maple (drawer side)
P1	1	¾ × 2¾ × 17" maple (drawer back)
P2	1	¾ × 4¾ × 17" maple (drawer back)
Q	2	¾ × 16¾ × 17" plywood (drawer bottom)
R	2	¾" No. 6 rh woodscrew
S	as reqd.	1" No. 6 rh woodscrew
T	4	2½" No. 8 fh woodscrew
U	as reqd.	No. 20 plate
V	as reqd.	¾"-dia. × 2" wood dowel
W*	3	1¾ × 3" butt hinge
X1**	1	door pull
X2*	1	door catch
Y**	2	pair 16-in. drawer slides (Accuride 3037)
Z1**	1	vent grille
Z2	as reqd.	⅜" escutcheon pin
Z3**	1	oak grommet

*Hinge (No. 106HI) and catch (No. 141CD3) available from Whitechapel Ltd., P.O. Box 136, Wilson, WY 83014; 800-468-5534.
**Drawer slide (No. 32813), vent grille (No. 62661), door pull (No. 62935) and grommet (No. 62372) available from Rockler Woodworking and Hardware, 4365 Willow Dr., Medina, MN 55340; 800-279-4441.
Note: All plywood to be veneer- or MDF-core with oak face veneers.

ILLUSTRATION BY EUGENE THOMPSON

Clamp two stiles together to form a base for a plunge router, and cut the stile mortises using a spiral up-cutting bit.

With a stile held securely to the bench, use a chisel and mallet to cut the rounded ends of each mortise square.

With a clamp on the miter gauge serving as a workpiece stop, cut the side rail tenons with dado blades in the table saw.

Set the table saw blade to 45°, place a stile against the miter gauge, and cut the chamfer on each edge of the stile.

mortises and on the rail tenons, then join the rails to one stile. Slide the panel into position (Photo 8), but be sure not to get any glue on the panel's edge or its groove. Now you can place the second stile in position and clamp the assembly.

Cut the rounded top corners on the back rail using a sabre saw. Mark the locations of the joining-plate slots in the rail and top shelf, and then cut the slots. Dry assemble the two pieces (Photo 9). Next, spread glue in the slots, on the plates and on the edge of the glue joint, and clamp the two parts together.

Cut out the notches in the middle shelf, mark the position of the shelf dowel holes, and then use a doweling jig to bore the holes

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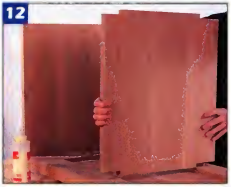
Assemble the case sides by applying glue only to the mortises and tenons, not in the panel groove or on the panel edge.

After you have cut the joining-plate slots in the top shelf and back rail, test fit the pieces, then glue and clamp them together.

Make the center case shelf, cut the notches in its ends, and bore the holes in the notches using a doweling jig.

Using the router with an edge guide, make two or three passes, and cut the rabbet on the top rail/shelf assembly.



Apply glue to the slots, dowel holes, joining plates and dowels, then assemble the shelves to one case side.

The drawer blocking is made from two pieces of plywood with solid oak facing. Screw the blocking to the case side.

(Photo 10). When you've completed this, bore matching holes in the case side stiles.

Finish laying out the joining-plate slots in the bottom shelf and case sides, then cut the slots. Clamp a straightedge to the sides to position the plate joiner.

Next, use the router and edge guide to cut the rabbet along the back edge of the top rail/shelf assembly (Photo 11) and along the back edges of the case sides. Use a chisel to square the rabbet ends.

Mark the hinge mortise outlines on the case, and cut the outline using a chisel and a marking gauge. Pare the mortise to depth with a chisel.

If you plan to set a turntable on the top shelf of the case, you should bore a hole through the shelf for a wire grommet. (See the materials list for grommet information.) The grommet we used requires a 1¾-in.-dia. hole.

To assemble the case, spread glue in the plate slots, dowel holes and on the dowels and plates, then join the shelves to one of the case sides (Photo 12). Take care not to get any glue on the portion of the middle shelf that abuts the side panels. The panels must be free to expand and contract seasonally, and a glue bond will cause a panel to crack when this happens. With a helper, position the other side over the ends of the shelves, and then clamp the assembly. Compare opposite diagonal measurements on the case to check for square, then let the glue cure.

Glue together two pieces of ¾-in.-thick plywood to form the drawer blocking, then glue a solid oak strip to the block as a facing. Note that the grain on the facing should run horizontally to match the drawer faces. Screw the blocking to the case side (Photo 13).

Cut a piece of ½-in.-thick oak plywood to size for the case back, then lay out the position of the vent-grille cutout. Drill clearance holes at the corners of the cutout, and use a sabre saw to remove the waste. Fasten the grille to the back with escutcheon pins, and remember to bore a 1½-in.-dia. hole in the back for power cord access.

Finally, screw the back to the case.

Making Drawers

Rip and crosscut the drawer parts. Install a dovetail bit in the router, and set the router to make a ¼-in.-deep cut. Cut the dovetail dado in the drawer sides and the stopped dado in the drawer face (Photo 14).

Clamp a tall fence to the router table, and clamp a backup block to each drawer side and back when you cut the dovetail on these parts (Photo 15). The backup block—rather than the workpiece—tears out when it exits the bit.

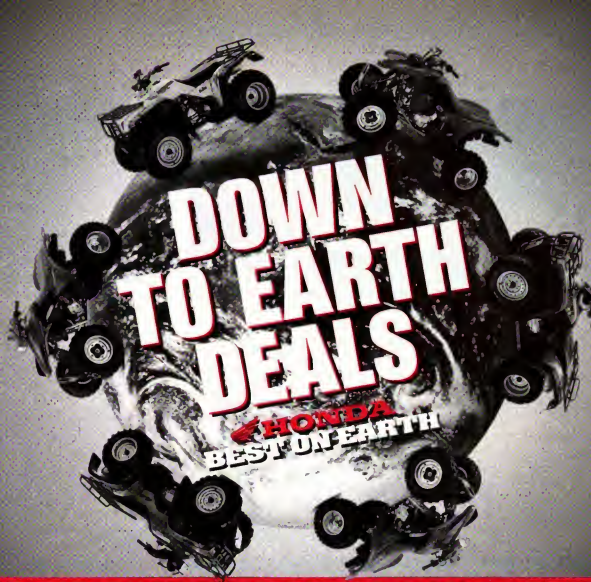
Next, use a router and edge guide to cut the drawer bottom grooves in the drawer sides and the stopped groove in the drawer face.

After marking the curved cutout on the drawer faces, make the cuts with a sabre saw. Use a router and cove bit to shape the edge of the cutout (Photo 16).

Next, apply glue to the mating parts of the drawer joints, and then slide the parts together—you should not need to clamp the assembly. Now rip and crosscut the plywood bottom panels and screw each bottom to the drawer back.

Install drawer slides in the case

(Please turn to page 118)



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Clamp each drawer front to the workbench, and then use a router and dovetail bit to cut the dovetail dadoes.

and drawer rails on the drawers, using screws only in the slides' positioning slots. Adjust the slides so the drawers move smoothly and the drawer faces have a 1/16-in.-wide margin on all edges. Install the remaining screws.

The cabinet door is built in essentially the same way as the rest of the cabinet. Keep in mind, however, that the panel groove is only 3/8 in. wide, so you must cut a shallow rabbet around the inside edge of the panel. To do this, use a straight bit

Cut the drawer side's dovetail in the router table. Clamp a backup block to the side, then move the side over the bit.

in the router table, and push the panel slowly over the bit (Photo 17). Cut the cross-grain rabbets first, then cut the rabbets along the grain. Any small amount of grain that is torn out while cutting across the grain will then be removed.

Like the drawers, the door is installed on the case with a 1/16-in.-wide space on all four sides. Transfer the locations of hinge mortises to the door edge, and then cut the mortises using the same techniques you used on the case. Mount the

Cut out the profile on the top edge of each drawer front. Next, use the router to cut the cove along the edge.

Install a straight bit in the router table, and then slide the door panel over the bit to cut the rabbet on the inside panel edges.

door pull and catch. The pull shown in the photo has been discontinued, however, a pull that looks similar to it is specified in the materials list.

For staining, remove the door, drawers, back and all hardware. Sand all parts as you did the side panels. We stained our cabinet with water-soluble aniline dye-based stain (Brown Mahogany, Item No. W1370, Woodworker's Supply, 1108 N. Glenn Rd., Casper WY; 800-645-9292).

This water-soluble stain is more resistant to sunlight fading than other aniline stains, but it will raise the grain—the water in the stain makes wood fibers on the surface stand up, giving the surface a fuzzy texture. To prevent this, wipe the wood surfaces with a lightly dampened sponge, and let all the pieces dry—this will raise the surface fibers. Next, gently sand off the raised fibers using 220-grit sandpaper, then apply the stain.

To finish the cabinet, apply three coats of Waterlox Transparent according to the manufacturer's directions. When the last coat is dry, burnish the surface with 4/0 steel wool, and polish it with a soft cloth. Complete the project by reassembling all the pieces and installing the cabinent hardware. PM

PREMIERE ISSUE

Popular Mechanics
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FURNITURE PROJECT

Cherry Chest Of Drawers

It's often called a dresser, sometimes a bureau and usually—in the woodworking world—a chest of drawers. We've all seen countless examples of this piece, from the basic particle board models in discount stores to the finely wrought antiques seen in any number of museums. No matter what its station, it's one of the most useful projects you can build and one of the best for developing your skills.

Its composition isn't terribly complicated, just a chest (often called a case) that holds five drawers. But to get from that pile of rough lumber sitting on your floor to a finished piece that looks like the one you see here requires a good bit of time, effort and a methodical approach.

The first step is stock preparation, when you cut to size, flatten and smooth all the component parts. Next comes joinery, when you fit and assemble the parts. And finally you turn to finishing, when the assembled piece is covered with a protecti[illegible] lot easier [illegible] than it is t[illegible]

The techn[illegible] materials lis[illegible] this story exp[illegible] goes together [illegible] ished sizes of a[illegible] good idea to stu[illegible] proceed. The step-by-step photos, that also follow, give you precise focused views of the individual operations that are required. Again, it makes sense to closely inspect these first.

Stock Preparation

The first step in this process has nothing to do with tools and doesn't even take [illegible]lace in the shop: [illegible]'s buying the lum[illegible]r. If you want to [illegible] a hardwood, like [illegible] cherry we fea[illegible]here, you'll gen[illegible] have to go to a [illegible]od lumber [illegible] listed un[illegible]er in your [illegible]w Pages. [illegible] retail [illegible]e are [illegible] suppli[illegible]hat [illegible]ways [illegible] they treat [illegible] what you [illegible] explain that you're [illegible] expert and so you need their help and they respond in a decent cooperative way, then do business with them. They may not have the greatest selection and their prices might be higher than the next guy, but the advice a good dealer can

(Continued)

New From The Editors Of
Popular Mechanics
WoodWork, the bimonthly newsletter for people who are crazy about woodworking. If you've been hoping for more woodworking articles from POPULAR MECHANICS, we've created WoodWork for you. Every month, WoodWork will have feature after feature on woodworking and nothing but woodworking.

Legs

The legs on this piece also function as stiles for receiving the back and side panels. As such, they require quite a bit of machining to create the proper joints. The outside corners are also ornamented with a tasteful bead to lend some distinction to the piece. All these operations are handled with a router, and because accuracy is essential, we show the router mounted to the underside of a small table.

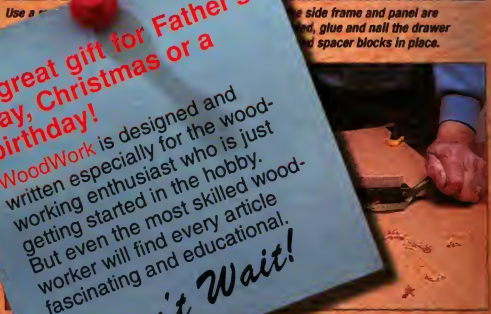
There are many commercial router tables available, some as inexpensive as $50 while others can cost several hundred dollars. You can, however, easily make one for yourself using scrap lumber f[illegible] legs and rails, a good piece [illegible] wood for the top and a piec[illegible] tic laminate to cover the ply[illegible] you feel like splurging. We've [illegible] plied plans for a simple table i[illegible] next couple of pages.

You may not want to stop wo[illegible] now to build this table, which is perfectly understandable. The pro[illegible] ect may well be going too slowly fo[illegible] your tastes without delaying the progress any more. But the table provides so much more control and accuracy when using a router that [illegible] to build it is well spent. [illegible] router [illegible] and router work, even with a bunch of guides clamped in place, is

(Continued)

Use a [illegible]

[illegible] side frame and panel are [illegible]ed, glue and nail the drawer [illegible] spacer blocks in place.



[illegible] and clamp the top boards together. Once the glue is dry, use a hand plane or cabinet scraper to smooth the top.

A great gift for Father's Day, Christmas or a birthday!

WoodWork is designed and written especially for the woodworking enthusiast who is just getting started in the hobby. But even the most skilled woodworker will find every article fascinating and educational.

Don't Wait!

GREAT NEW TOOLS

New Oscillating Spindle Sander

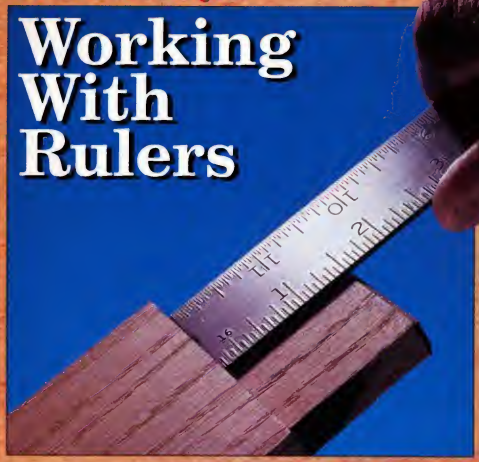
Like many pursuits, woodworking requires tools. Most of the tasks undertaken simply can't be done any other way. Your fingernails may be up to removing the impossibly tenacious stickers on everything from brooms to tomatoes, but they can't do much to plane smooth a plank of red oak.

The ongoing demand for new tools is substantial and tool manufacturers are more than happy to develop new products to keep the process churning. A good example is the just-introduced Porter-Cable Model No. 121 handheld Oscillating Spindle Sander. This is a clever tool that is really nothing more than a simple drum sander, mounted in a portable tool, that oscillates (moves up and down about ¼ in.) as it spins. This makes for faster stock removal, longer life for the abrasive drum, less clogging of the abrasive grit and nearly perfect 90° edges. It's designed primarily for smoothing the edges of curved surfaces, something that is usually done with a hand tool called a spokeshave or with a sanding drum chucked into a portable electric drill.

Of course, this tool is not really a new idea. Oscillating spindle sanders have been longtime members of the stationary shop equipment club. But to move that high-end capability into a portable power tool is something worth crowing about even if the tool isn't for everyone.

The tool costs about $250 and is available from stores and mail-order catalogs that carry the Porter-Cable brand. For information, write to Porter-Cable Corp., 4825 Hwy. 45 N., Jackson, TN 38305.

Working With Rulers



If you forget about pencils fo[illegible] and [illegible] our fold- moment, there's no more bas[illegible] ng of woodworking tool than a sim[illegible] ow ruler. Any number of these r[illegible] ing devices are commonly [illegible] able, including folding rul[illegible] tractable steel tapes, and [illegible] wood rulers with a steel [illegible]

The folding rule is ligh[illegible] compact and usually c[illegible] sliding brass extensio[illegible] into one end of the te[illegible] permits easy and ac[illegible] measurements. Un[illegible] tool is also pretty f[illegible]

The straight wood rulers are lightweight and very convenient, but in a woodworking shop they are generally used for rougher, more pedestrian work.

For pure accuracy the king of rulers is the steel bench rule. Its straight blade has graduations, in fractions of an inch, precisely engraved on both edges. Some even have English measure on one side and metric markings on the other. When new, the blades are flat and straight and you should do what you can to keep them this way. Bench rules come in a variety of lengths and as time goes by you may accumulate several different sizes. A good starting assortment [illegible] include three rulers: 6-, 12- [illegible] n. models.

[illegible] gh these are uncomplicated [illegible] ere proper use is an essen- [illegible] l that should be developed [illegible] on. Without precise measur- [illegible] nd marking the finest wood [illegible] never become a successful fur- [illegible] are piece no matter who is doing [illegible] e work or what other tools are be

(Continued)

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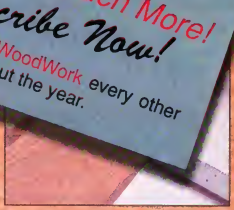
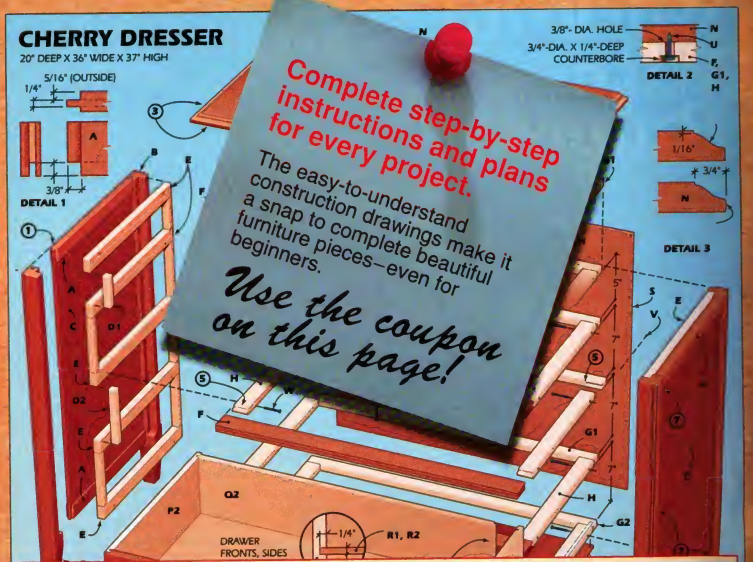
When marking a line against a ruler, angle the pencil point (left) so it bears on the ruler and the wood. Don't hold the pencil straight up and down (right).



To maintain exact ruler alignment when measuring across a board, hold a scrap block against the board edge and butt the end of the ruler to the block.

For the best results when marking a board, hold the ruler on its edge—not its surface—so the ruler graduations are in direct contact with the wood.



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Side Order

A side table for storing your CDs and tapes.

TEXT AND PHOTOS BY NEAL BARRETT

Electronic entertainment media are everywhere these days. Cassette recorders, VCRs, and DVD and CD players have changed the way we enjoy our leisure time. These devices provide an almost unlimited selection of enriching and entertaining pursuits. Unfortunately, the more we use them, the more storage space we need. Most entertainment-center cabinets provide for some storage, but often this space is insufficient.

To address this need, we designed a small side table with three drawers sized specifically for these items. The table has a traditional style that can fit in a variety of room settings. And it's proportioned to serve as a lamp table, end table or night stand.

It also has the advantage of being quite easy to build. It has a minimum of parts, and its

STORAGE TABLE

joinery is extremely basic. You should be able to complete it in three or four weekends, and still have time to mow the lawn or take a well-deserved nap.

We built our table from solid mahogany and mahogany plywood, but it would look equally attractive in cherry or walnut. It has drawer boxes built of solid maple with slide-in plywood bottoms.

This traditional-looking storage table keeps your CDs and tapes out of sight, but at the same time makes them easily accessible.

Building The Base And Top

Begin construction on your side table by cutting slightly oversize blanks for the table sides, back and bottom from mahogany plywood. Rip and crosscut mahogany edge-banding strips.

Glue and clamp the strips. After 20 minutes, scrape off excess glue, then let the glue cure. Use a plane to trim the edge banding flush to the panel (Photo 1). Next, trim the panels to finished dimension.

Rip and crosscut the table legs, and mark their tapered profiles. Use a band saw to cut the legs to shape (Photo 2). Clamp each leg to the workbench, then use a block plane to remove saw marks (Photo 3).

Lay out the locations of the joining-plate slots on the sides, back, bottom and legs. Use the plate joiner to cut all the slots except those in the rear legs that receive the case back. These are cut later. Hold a leg firmly to the workbench, and cut the joining-plate slot (Photo 4). Cut the joining-plate slots in the panel edges and along the bottom edge of the back panel (Photo 5).

Apply glue to the joining-plate slots in the legs, the slots in the side panels and the joining plates. Then, clamp together the two subassemblies, each consisting of two legs and a side panel (Photo 6).

When the glue has fully cured on the subassemblies, use the plate joiner to cut the slots in the rear legs for the joints with the back panel. Clamp a straightedge to the assembly to help position the plate joiner when cutting the slots. Note that these plate slots will slightly intersect with the plates that form the side-panel joints.

Next, join the back and bottom panels with joining plates, glue and clamps (Photo 7). Complete the base by joining this subassembly with the side panels and legs (Photo 8).

Cut the plywood panel for the table's top, and prepare the edge banding. Cut miters on the ends of two pieces of edge banding so they correspond to the dimensions of the top, and then glue and clamp these to the top. Cut mitered ends on the remaining edge banding, then glue and clamp these to the top (Photo 9).

Gently plane the edge banding flush to the top after the glue has cured, and cut the molding on the edge banding with a router and cove bit. We used a shallow-cutting cove bit (Item No. 387, MLCS, Box 4053/C-24, Rydal, PA 19046; 800-533-9298).

Cut joining-plate slots in the bottom of the tabletop, and then glue and clamp the top to the table base using standard plate-joining procedure.

Drawer Making

Rip and crosscut the drawer box pieces and the bottoms, then cut the rabbets and grooves in them using a dado blade in a table saw. Drill 1/16-in.-dia. pilot holes in the

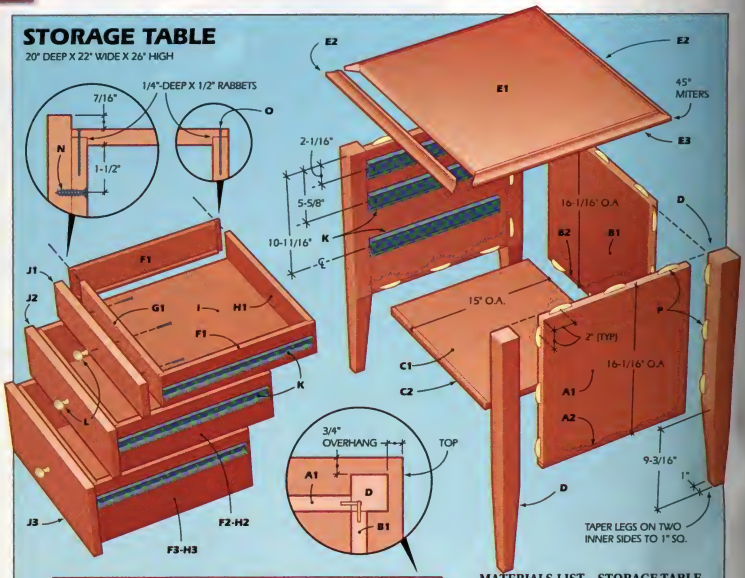
1 *Glue and clamp strips of mahogany to the plywood panel edges, and then trim them flush to the panel with a block plane.*

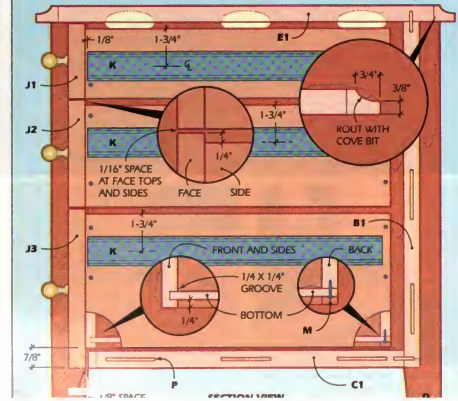
2 *Mark the taper on two faces of each leg, then cut the tapers on a band saw. Stay on the waste side of the pencil line.*

3 *Clamp each leg to the workbench top. Next, use a block plane to remove saw marks and refine the leg taper.*

STORAGE TABLE

20" DEEP X 22" WIDE X 26" HIGH





MATERIALS LIST—STORAGE TABLE

Key	No.	Size and description (use)
A1	2	¾ × 15 × 15¼" plywood (side)
A2	2	¾ × ¾ × 15" mahogany (edge banding)
B1	1	¾ × 15⅝ × 17" plywood (back)
B2	1	¾ × ¾ × 17" mahogany (edge banding)
C1	1	¾ × 14¾ × 17" plywood (bottom)
C2	1	¾ × ¾ × 17" mahogany (edge banding)
D	4	1¾ × 1¾ × 25¾" mahogany (leg)
E1	1	¾ × 18 × 20" plywood (top)
E2	2	¾ × 1 × 22" mahogany (molding)
E3	2	¾ × 1 × 20" mahogany (molding)
F1	2	½ × 3¾ × 14¾" maple (drawer side)
F2	2	½ × 4¾ × 14¾" maple (drawer side)
F3	2	½ × 6¾ × 14¾" maple (drawer side)
G1	1	½ × 3¾ × 15¾" maple (drawer front)
G2	1	½ × 4¾ × 15¾" maple (drawer front)
G3	1	½ × 6¾ × 15¾" maple (drawer front)
H1	1	½ × 2¾ × 15¾" maple (drawer back)
H2	1	½ × 4¾ × 15¾" maple (drawer back)
H3	1	½ × 5¾ × 15¾" maple (drawer back)
I	3	¾ × 14¾ × 15¾" plywood (drawer bottom)
J1	1	¾ × 3½ × 16¾" mahogany (drawer face)
J2	1	¾ × 5 × 16¾" mahogany (drawer face)
J3	1	¾ × 7¾ × 16¾" mahogany (drawer face)
K*	3	pair 14" drawer slides (Accuride 3832)
L*	3	knob
M	3	¼" No. 6 rh screw
N	9	1" No. 6 fh screw
O	36	1¼" 4d finishing nail
P	30	No. 20 plate

*Drawer slides (No. 32474) and knobs (No. 36608) available from Rockler Woodworking, 4365 Willow Dr., Medina, MN 55340; 800-279-4441.

Note: All plywood to be veneer- or MDF-core with

PHOTOS BY DUANE THOMPSON

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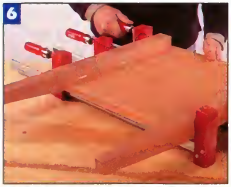
4 *Mark joining-plate centers on each leg, then cut the plate slots. Hold the leg firmly to the work surface while doing this.*

5 *Clamp a tall backstop to the workbench, and hold a panel firmly against it. Cut joining-plate slots in the panel edge.*


6 *Assemble two legs and one table side with glue and joining plates. Apply pressure with a clamp at each plate location.*

7 *Glue and clamp together the table back and bottom. Take this subassembly and join it to the leg-side subassemblies.*

8 *Use bar clamps at the location of each joining plate to evenly distribute pressure when assembling the table case.*

9 *Glue and clamp two mitered edge-banding strips to the top. Then, cut the mitered banding strips that fit between them.*

drawers (Photo 10). Slide each bottom into its groove (Photo 11).

Install the drawer slides on the table's sides and on the drawer boxes according to the manufacturer's instructions.

Cut drawer faces to size and install them (Photo 12). Install a knob on each drawer face.

Install the drawers, and adjust the slides so the drawers have a uniform ¼-in. margin on all sides.

Remove the drawers from the table and remove the knobs and slides before finishing. Sand all surfaces with 120-, 150-, 180- and 220-grit sandpaper. Dust off the surfaces completely between grits.

Since mahogany is an open-grained wood, the first finishing step is to apply a grain filler. We used Behlen Pore-O-Pac Paste Wood Filler (Item No. 843-812, Woodworker's Supply, 1108 N. Glenn Rd., Casper, WY 82601; 800-645-9292). To apply the filler, thin it with naphtha to a creamy consistency, then spread it over the surface with a paintbrush. When the filler appears dull, scrub it off with a burlap rag. Let the filler dry overnight, then sand the surface

(Please turn to page130)

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The drawer box is built with rabbeted and grooved pieces. Assemble the box with glue and finishing nails.

Cut the plywood drawer bottom to size. Once the glue has cured, slide the drawer bottom into its groove.

Clamp the drawer front to the drawer box, bore pilot holes, and attach the front with flathead screws.

with 320-grit sandpaper.

We stained our table with Behlen Solar-Lux, a non-grain-raising, dye-based stain (Item No. 847-466, Medium Brown Mahogany, Woodworker's Supply). Although this stain is meant to be applied with a spray gun, it can be brushed on if you add a retarder to it (Item No. 847-585, Woodworker's Supply). Let the stain dry overnight before applying the first coat of Waterlox Transparent Finish (Item No. 294-001, Woodworker's Supply). Apply this according to the directions on the container. PM

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—Angela L. Orlando, FL

Sometimes I think exterminators scare me more than they do pests. Maybe it's the uniform, maybe it's the hard hats, but when I see them getting out of their trucks with protective clothing and tanks full of dangerous chemicals, I begin to wonder. I have small children, a dog and a cat, so I'm not too keen on the idea of somebody bombarding my home and yard with dangerous chemicals. On the other hand, I'm not too fond of ants, flies, rodents, fleas, spiders, cockroaches and other common household pests. Recently, a neighbor of mine told me about a revolutionary new way of ridding my home of pests without endangering my family. It's called PestContro.

Double trouble for pests. PestContro combines electromagnetic technology and ultrasonic waves to solve a variety of household pest problems. This amazing device uses your home's existing electrical wiring to create a shifting electromagnetic field. This creates an environment that is uncomfortable for pests, driving them from their hiding places in walls, ceilings and floors. Simultaneously, a harsh, ultrasonic siren blasts sound from the unit's dual speakers. This sound is inaudible to humans, but it creates an incredible disturbance for pests. In two to four weeks, the pests are driven from the area.

Safe and effective. Even though it makes life unbearable for a variety of insects, rodents and other pests, PestContro is harmless to children and household pets, such as cats, dogs, fish and birds. The unit features a two-setting intensity selector that allows you to adjust the setting for those household pets that may be affected by certain pitches, like lizards, hamsters and gerbils.

Versatile Pest Control

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- Squirrels
- Other pests...

Just plug it in. Simply place the PestContro unit in a centrally located area and it goes to work immediately, using a new technology called "phase-shift-current." By shifting the electromagnetic field throughout the home's wiring, it controls pests in the walls, ceilings and floors, where the majority of pests live. This interference covers an area of up to 5,000 square feet. Then, the dual speakers each blast 120 dB of ultrasonic sound. You can use the intensity selector to customize your control. Lower ultrasonic sounds tend to influence larger creatures, such as rats, lizards, roaches and spiders. The higher setting is more irritating to smaller pests, such as ants, ticks, fleas and other insects.

Practical features. In addition to selecting the intensity, you can use the pitch selector to choose a fixed pitch or a variable pitch that sweeps within a range of ultrasonic frequencies. You can hear the difference by pushing the Test button, which lowers the ultrasonic frequencies to an audible level. The Random On/Off setting automatically turns each speaker on and off randomly to keep pests from becoming accustomed to the ultrasonic sounds. There's even a Floor Night Light for placement in a hall or dimly lit area. Each LED represents different properties of PestContro. The Red LED flashes continually when the unit is powered. The Green LEDs represent sound emitted from each of the speakers and flash randomly in the Variable setting. PestContro is registered with the EPA and is UL approved. Since it uses less electricity to operate than a 40 watt light bulb, it costs just pennies a day to operate.

Repel pests from your home...risk-free. Why wait to use the latest technology to solve your home's pest problems? PestContro comes with a two-year manufacturer's limited warranty and TechnoScout's exclusive risk-free home trial. If you are not satisfied for any reason, simply return it within 90 days for a full "No Questions Asked" refund.

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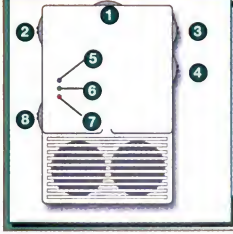

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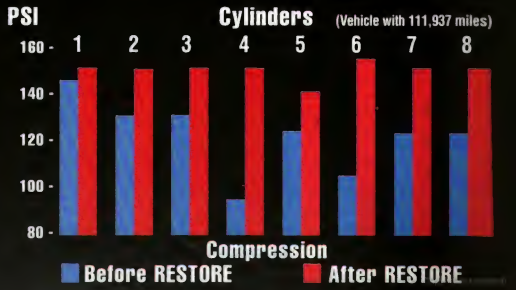


Automotive Car Care

Auto Clinic

BY MIKE ALLEN

Rough Trade

I had a local auto parts store machine the brake discs on my pickup truck last week when I replaced my brake pads. When I picked up the discs and the new pads, the counterman told me to be sure to sand the discs before I installed them. Not wanting to appear stupid, I just nodded and paid.

At any rate, I installed all the parts, and everything seems to be working fine. What in creation was he talking about?

TOM GRABLETON
VIA INTERNET

When a brake disc is machined, the surface texture left behind is determined by a number of factors: the sharpness of the cutting bit, the feed rate, the hardness of the material, etc. If the machinist isn't careful, he can also leave spiral grooves like those on an LP record. Brake pads shouldn't have to do the job of smoothing off all the high spots the cutting bit leaves behind, and most car manufacturers specify the use of sandpaper to lightly knock off the hills left behind. It doesn't take much—just a few seconds with a piece of relatively fresh 80- to 100-grit sandpaper while the disc is still mounted on the lathe. It's best to use an orbital or DA sander.

Needless to say, the machinist should have done this before he returned the discs to you. However, you can sand the discs yourself with an orbital sander after they're back on the hubs, or if you've used an on-the-car lathe to turn them. Don't overdo it—just take off the high spots on the texture so it doesn't feel like, well, sandpaper. Thirty seconds total on each disc is plenty. You can also use a sheet of sandpaper.

ILLUSTRATION BY DON MARRES

Boosted

I have an older motorhome with a Dodge 440 engine. Is it better to use premium gasoline or to use regular with an octane booster?

CATHY JENSWOLD
VIA INTERNET

It makes no difference. I assume you are asking this because you have evidence of detonation with regular or midgrade gas, and a mechanic has checked out your RV and suggested that you need to use a higher octane fuel. How you get there is irrelevant, and the only real issue is economic, especially with premium fuel being pricey. An octane booster might be cheaper, especially if you buy it ahead of time in bulk (and feeding a thirsty, big-block motorhome makes that a smart move).

Aside from that is the potential need for leaded fuel in your older motorhome. How old? If the engine is of mid-'70s or earlier vintage, it may not have hardened valve seats and won't live long in motorhome service on unleaded gas. When the valves recede, you can have the

cylinder heads removed and hardened valves and seats installed. Use a thicker, shim-type gasket to reduce the compression ratio, and you should be able to downgrade to a lower octane rated gas.

Bleeding It Flush

What is the difference between flushing a brake system and bleeding a brake system?

ARTHUR P. SAMUELSON
VIA INTERNET

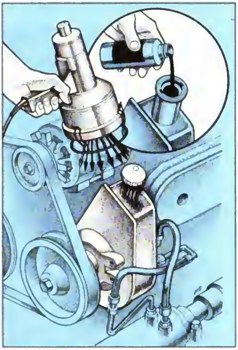
Flushing means to replace the old brake fluid with fresh fluid. This should be done every two years or so. Bleeding, technically, means removing any air trapped in the system. This needs to be done anytime the system has been opened up for maintenance or when any component—like a caliper or wheel cylinder—leaks air into the system. The two terms are usually used interchangeably. Modern antilock brake systems are potentially difficult to bleed because air can be trapped in the high-pressure ABS pump and

Psychedelic!

CAR CARE TIP

Oil was dripping from everywhere. From the engine, from the middle of the car, from the rear bumper. Obviously, a major oil leak had sprung from somewhere. But where? Every surface of the engine compartment, top and bottom, was dripping like a pig on a spit. It's not a good idea to pressure wash modern engines because the seals on electrical sensors are only meant to hold up against road spray, and using too much pressure blasts water into places it wasn't meant to go. And so, an hour of backbreaking cleanup later, there was still a thin sheen of oil. Idle testing did not reveal the leak—but a brief test drive had oil everywhere again.

Time to bring out the big guns. I added a vial of UV-fluorescent dye to the crankcase, and let the engine idle while I plugged in a portable, high-intensity black light and turned off all the shop lights. Sure enough, the leak, or should I say leaks, showed up within a minute as bright purple stains. And it made the Jimi Hendrix and Grateful Dead posters in my garage look terrific.



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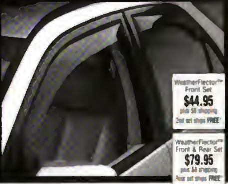

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(Please turn to page 136)

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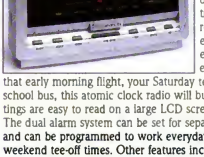

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turn into froth. Avoid getting air into these systems, and flushing them will be straightforward.

Ground Zero

I thought you could best settle a discussion I was having with friends. They all said that storing a car battery on a cement floor would ruin it. I asked around and a lot of people seem to agree—but nobody can explain why. I don't believe it. What do you say?

BMACINTOSH
VIA INTERNET

It's yet another urban legend—but one based in part on fact. Lead-acid car batteries will lose some of their charge constantly because current will creep across the top of the battery case through the damp film of dirt and electrolyte lingering there. This was particularly a problem in the early days of electricity when batteries had wooden cases. A clean, dry battery will hold its charge for months. A battery whose top is covered with a lot of road dirt and sulphates will lose its charge within a month or less. What does this have to do with concrete? Nothing, except that concrete tends to be cold and damp, damper than other places where a battery might be stored for a few months—like, say, a dry wooden shelf at waist level. A battery that's totally discharged will be damaged.

So, to properly store a battery, clean the battery case with baking soda and water to neutralize any acid, then with a few drops of detergent to cut any grease. Next, rinse thoroughly and dry. Check the electrolyte level, and add distilled water if needed. Charge the battery completely, and top off the charge every four to six weeks. You can either use a conventional 6- to 10-amp charger for a few hours or an automatic battery maintainer to avoid overcharging. PM

DO YOU HAVE A CAR PROBLEM?
Just ask Mike about it. Mail your question to Car Clinic, Popular Mechanics, 810 Seventh Ave., New York, NY 10019. While letters, faxes or phone calls cannot be answered individually, problems of general interest will be discussed in the column.

SERVICE TIPS

- Ford says a short to ground in one of the entry switches and/or the key cylinder causes the interior lights to stay on in some 1998-00 Contours/Mystiques. Technical Service Bulletin (TSB) 99-24-8.
- If the PRNDL display sometimes seems to go out when the headlights come on in your GM vehicle up to 2000, you may have the dimmer control set too low. TSB 99-08-42-009.
- Do the windows on your 1996-98 four-door Honda Civic bind or tend to pop out of their channels? New window regulators should do the trick. TSB 98-082.
- Does your 1996-99 Volvo 850/70 Series whine from the final-drive? It may need a driveshaft damper retrofit, or you may have to replace it with an entirely new damper. TSB 4-43-0011.
- Toyota has a new Air/Fuel Ratio Sensor (PN 89467-41021) for 1998-99 California RAV4s that turns on the malfunction indicator light and stores trouble code P1133. TSB EG010-99.

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Revolutionary new formula stops hair loss to give back your youthful appearance

Do you secretly worry that your thinning hair will gradually get worse and worse...and that eventually you'll become bald and "invisible" to women? The good news is, your worries are over because now there's **Folliguard!** Folliguard is the revolutionary new hair restoration breakthrough guaranteed to stop hair loss and regrow thicker, fuller new hair!

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Clinical tests prove the ingredients in Folliguard block the formation of the root-choking hormones that cause your hair to fall out. That means, with Folliguard, you'll not only stop losing your hair, you'll also start regrowing fuller, thicker hair where it's thinning or balding.

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With Folliguard, you'll get the results you want, guaranteed. So, if you want to stop losing your hair and finally get back your youthful, more attractive appearance, call toll-free now at **1-800-705-5419, ext. 106** and get your risk-free trial of Folliguard.

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Automotive Car Care

Replacing Spark Plug Wires

BY PAUL WEISSLER

Degree of Difficulty

EASY

Before easing

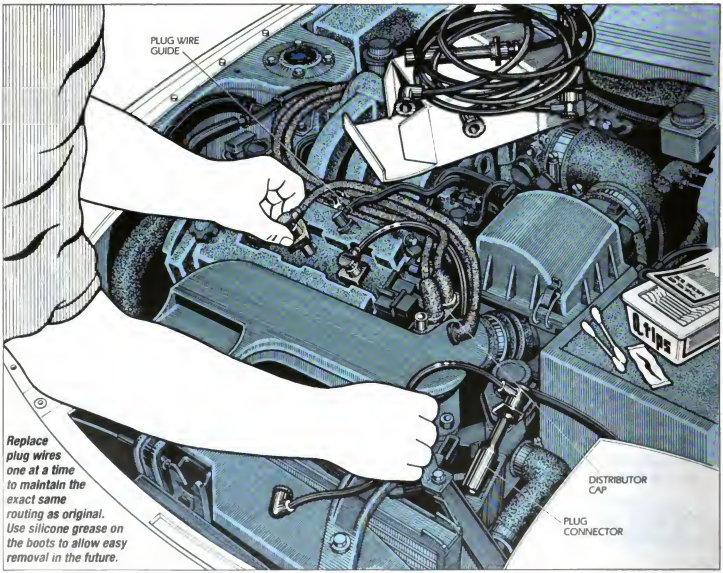
out of the fast-food's parking lot, you grab a sip of the hot coffee you picked up at the drive-thru. You take your time as you place the cup in its holder in the center console. No hurry. The approaching traffic may be moving fast, but it's far enough away for you to accelerate up to cruising speed. Good thing, because at about half-throttle you feel the engine misfire. The closing traffic has time to back off and let you sputter up to road speed. But now your engine sputters like a Harley idling at the curb, even at normal traffic speeds. And there's coffee all over the console from the vibration.

SATURDAY MECHANIC

What's Up?

A brief underhood inspection confirms that all the vacuum hoses are on and that none of them have been burned open by leaning against the exhaust manifold. You've touched every sensor connection to see if it's on tight, you've even checked for trouble codes.

However, not everything calls for



Replace plug wires one at a time to maintain the exact same routing as original. Use silicone grease on the boots to allow easy removal in the future.

ILLUSTRATION BY RUSSELL J. VON GAERS

(Please turn to page 140)

Remember to change your anti-freeze again.

In 2005.

So technologically advanced, it lasts up to five times longer than conventional coolants.

Havoline® Extended Life Anti-Freeze/Coolant is guaranteed to protect your cooling system for an amazing five years or 150,000 miles. But that's just one of the reasons it's the world's top-selling extended-life coolant.

Havoline® Extended Life Anti-Freeze/Coolant can actually help extend the life of your water pump, the heart of your cooling system. It contains no silicates—tiny, abrasive particles that can wear out water pump seals and send your water pump to an early grave. And you can forget about cooling system corrosion and boilover.

Here's another cool tidbit: its thinner, protective coating transfers heat so effectively, your engine keeps its cool even under high load conditions.

It protects whatever you drive, however you drive. It meets U.S. car manufacturers' requirements, Japanese car manufacturers' silicate-free requirements and European car manufacturers' phosphate-free requirements. And the technology in Havoline® Extended Life Anti-Freeze/Coolant is required for virtually every GM car on the road since 1995.*

So, if you are the owner of a 1995 GM vehicle, it's time for a refill. Get it now. Then forget about it for another five years.

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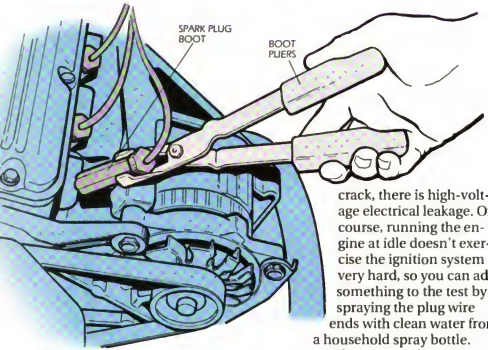


Inexpensive boot pliers allow you to remove stuck plug wires without damage.

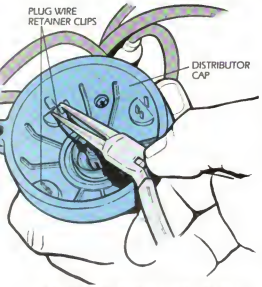
high-tech diagnostics and the latest scan tester. Engine misfire often is caused by leaking spark plug wires, so visual inspection could reveal what's wrong. The jackets may be damaged from the outside by abrasion caused by engine vibration (particularly at the plug-end boots), a hot engine compartment, spilled fluids or battery acid, multiple disconnections and reconnections for other service, or even a family of nesting rodents.

Run the engine in near darkness, and then look and listen. If you see little electrical arcs, or hear a snap-crack, there is high-voltage electrical leakage. Of course, running the engine at idle doesn't exercise the ignition system very hard, so you can add something to the test by spraying the plug wire ends with clean water from a household spray bottle.

Another test: With a jumper wire, ground the metal shank of a screwdriver that has a well-insulated handle. Then, run the tip of the screwdriver along the length of each wire and all around at the coil and plug boots. This will often produce an arc from the wire to the screwdriver.

Now look at the wires under good lighting. If they are damaged by abrasion, oil-soaked, cut, burned from contact with the exhaust, or have a dried-out look with heat cracks, it definitely shouldn't be a surprise if you see arcs in the dark under some conditions. However, if they look bad but there are no arcs, do a resistance check.

A conventional plug wire has a resistance of 10,000 to 15,000 ohms per foot of length—if it's measurably higher, the wire probably is bad. An absolutely failed wire will have a hairline break somewhere, and the resistance will be infinity.



Some wires are secured inside the cap by spring clips. Use needle-nose pliers here.

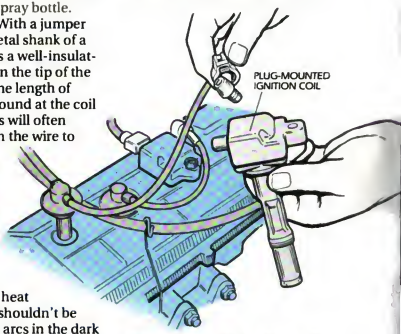
Out With The Old, In With The New

Once you've found a bad wire, the solution should be simple: Replace the plug wires.

First, you have to decide whether you want to buy from a car dealer at list price or get a quality aftermarket brand, if you have that choice. Prices for 1980s models may be under $35 for a popular make at the parts store. For a late-model V8, be prepared to pay the dealer up to $200 or more, even for a popular car.

A word of caution: You may not want "high-performance" wires, even if they fit your car (and they may be cheaper than a conventional type). Some high-performance wires are not the resistance type, and although they may do well on racing cars, they can affect the operation of underhood electronics by not containing radio waves.

The actual method of removing the old wire is not always "just pull it off." Pulling on the wire itself is sure to cause an internal separation. Of course, if you're replacing a bad wire, it may not matter, but if any one of the old wires is still good, it's best to keep it as a spare.



Many newer cars have individual coils mounted on the plugs. Short wires connect opposite-firing cylinders.

Grasp the plug wire by the boot at the plug end. If it's in a recess or is difficult to access for some other reason, use a spark plug wire tool. There are special pliers of all sorts designed to reach in and grasp the boot. They're not expensive, and having them could prove useful if you ever have to disconnect wires for other underhood service. Twist the boot if necessary to break the heat seal to the plug, then pull. As you do

ILLUSTRATIONS BY WENDY PAGANO

(Please turn to page 142)

It's Early...But Not Too Early

Why do I need winter tires?
How much do they cost?
What will they do for me?
When should I get them?

WINTER IS COMING!

WHY WINTER TIRES?

Refer to your owner's manual.
Many vehicles today are equipped with all-season tires representing a compromise in tire technology ...similar to having a pair of dress shoes as your only pair of shoes. Dress shoes are acceptable for most conditions, but when you want to go for a run you switch to running shoes. When you go out in the snow you'd better wear boots or end up right on your.....! Just as you need proper footwear, so too, does your vehicle. Equip it with four winter tires!!

CHANGEOVER?

To make an efficient changeover to your winter tires, we suggest that you buy a winter tire and wheel package. With your winter tires mounted and balanced on wheels purchased just for winter, being prepared for winter is easy. No need to dread the first snowfall or ice storm that catches you off guard. No need to wait in line at the local service center with others who need to have winter tires mounted and balanced (and then switched back in the spring). Call us for special pricing on winter wheels and wheel covers.

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6 Shipping

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7 Talk to an Expert

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- Our sales team members ARE our test drivers.

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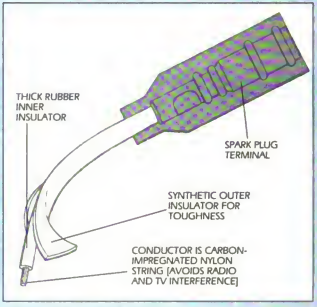
HOW IT WORKS: Spark Plug Wires

The spark plug wire has a seemingly simple job: Carry the high-voltage electricity produced by the ignition coil to the terminal of the spark plug. Once at the plug, the electricity travels to the other end of the plug, and jumps a gap between electrodes to produce the "spark" that ignites the fuel mixture. Because high-voltage electricity looks for an easier path to jump across than a pair of electrodes in a spark plug, containing the electricity within the wire takes a thick jacket of insulation, and some plugs have an outer jacket to resist cuts, high underhood temperatures, etc. If that outer jacket is damaged, the electricity may leak out to follow the easier path. In addition, high-voltage electricity produces radio waves, which can cause interference with all types of on-car electronic devices, from sensors and computers to radios and other entertainment systems. So, a simple length of solid wire can create problems.



The electrical conductor typically has a carbon-impregnated core of a suitable fiber, and everything from nylon to Kevlar has been used by different makers. That conductor (often covered by a second layer of a nonconductive material such as synthetic rubber) has enough electrical resistance to suppress radio interference without unduly weakening the spark. Some premium wires may have copper or stainless steel wire wound around the carbon core to reduce resistance. In some special applications in which minimum resistance is needed for engine performance, a solid metal wire has been used as a conductor, but over the inner layer of insulation is a layer of wound wire as a shield. On other types of wires, the outer jacket of the wire may have a metallic shield to prevent interference.

this take note if you feel some looseness at the connection (it may have been caused by engine vibration).

The plug wire usually is more accessible at the coil end, but it may not be a simple push-on. Since the early 1980s, Chrysler plug wires on engines with distributors have been held in the cap by spring clips. Compress the tangs of the clip with pliers and push out to disengage the wire. Some Japanese makes have thread-in "boots."

Follow the routing of a spark plug wire as if it were the road to success, because when it comes to engine operation, it really is. Every manufacturer includes little plastic guides, and although they may cost pennies to make and install, they're used to locate each wire so it doesn't cause crossfire (a transfer of high-voltage electricity from one cylinder's wire to the one that's next in the firing order). If you see one wire crossing over or under another at nearly right angles, that's an example of the routing strategy used to avoid crossfire.

Of course, on some engines with coil-on-plug ignition (COP), there is no wire and the boot is out of sight, out of mind. Although this type is immune to hungry rodents, a boot may suffer internal damage from high-voltage electricity or cracking from engine heat. It's even possible for spilled oil to flow under the cover and get down onto the boots on some cars, so have a rag handy when you're adding engine oil. It's impractical to check these boots with the engine running, so you've got to remove the ignition cover and lift the COP modules to make a physical inspection. There are some "hybrid" designs, with one coil on one plug to serve two cylinders. The coil directly feeds a plug in a boot underneath, and there's a plug wire (replaceable) to a second plug.

The COP boots alone are usually under $25 a set, and are strictly a dealer part. Just pull the coil/electronics module off the plug and then pull the boot off the module. If the boot is integral with the electronics the price could be $100 each.

There's no maintenance you can perform to extend the life of plug wires. However, before you install the boot on the plug, coat the inside with boot release lube (a silicone grease) to make it easier to remove next time. And whenever you work under the hood, avoid nicking the wires, spilling solvent on them, or mishandling if you have to set them aside while you work on something else. And if you see a wire dangling very close to the exhaust manifold, reposition it in its guide to gain some clearance. A penny of prevention can be worth a couple of hundred dollars of cure. PM

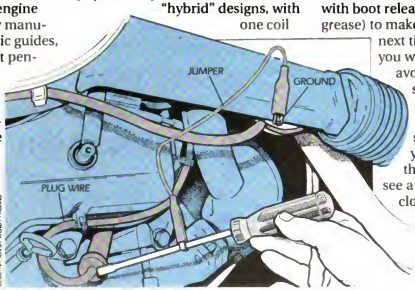


ILLUSTRATION BY WENDY PAGANO

Dampen the wires with a spray bottle and clear water, and look for arcs with a grounded, insulated screwdriver.

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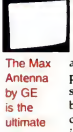

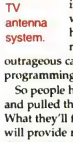

The Max Antenna by GE is the ultimate TV antenna system.

Electronic engineers agree—your television is only as good as the signal it receives. Unfortunately, antenna design has not kept pace with improvements in television quality and the features available. Both cable and satellite television systems have spent a great deal to improve the quality of their transmission, but they can be extremely expensive, they aren't available in all areas and may not provide access to local TV stations. The advent of digital broadcast television is about to change the face of television, and in the near future, broadcasters will begin transmission of these high definition signals. This will mean that you won't need to pay outrageous cable bills or subscribe to satellite programming to get the perfect picture.

So people have headed back up to the attic and pulled their old rabbit ears out of storage. What they'll find is that although rabbit ears will provide reception of over-the-air signals, they are just as ugly and just as difficult to adjust as ever. Luckily, there is a new antenna from GE that will provide breakthrough performance without making your family room look like something out of the fifties.

Fuzzy outlook. If you subscribe to cable, you receive a quality picture on most channels, as long as storms or other factors don't disrupt your service. Unfortunately, the interference caused by the signal bouncing off buildings and other large objects, known as multipathing, often results in "ghosting" or "snow." If you'd rather not pay a hefty monthly sum for the privilege of receiving a signal, your options have been limited, and your picture was likely to be distorted. You could always mount a huge antenna on your roof, but that's not even allowed in some neighborhoods. Then there's the problem of aiming the antenna at the broadcast source.

Clear alternative. The Max Antenna series from GE uses a revolutionary electromagnetic design to maximize installation flexibility and yield longer range reception of off-air VHF and UHF signals. Unlike a conventional dipole antenna, the Max Antenna can receive signals in both vertical and horizontal planes with minimum cross-polarization loss. This design allows for the first low-profile antenna solution that provides numerous installation options.

Superior components. The key to the superiority of this antenna is its ingenious use of the latest electromagnetic technology—providing high gain and full channel coverage as well as the greatest amount of mounting flexibility. First, the antennas were designed around a wide band element to achieve the greatest amount of gain in a relatively small space. Next, an amplifier and matching network was designed to enhance the reception of weak signals. This amplifier also adds very little distortion to the strong signals, giving it a balanced amount of gain. A filter on the amplifier board will allow for good matching between the antenna and amplifier. Special attention was paid to design an antenna-amplifier combination that would be completely compatible with the new digital transmission format. It has been designed for strong signal distortion rejection and a low amount of noise. The scientists who designed it followed certain optical principles to give the antennas good sensitivity in both the vertical and horizontal plane. It is omni-directional and requires no adjustments, orienting or fine tuning during use. You simply install it, set it and forget it.

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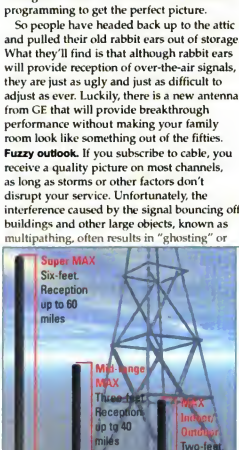

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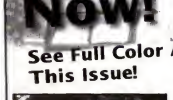

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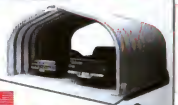

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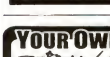

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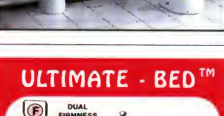

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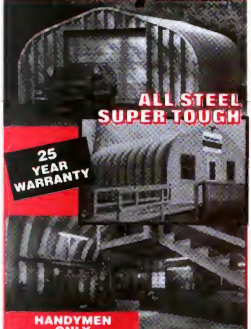

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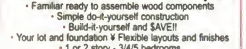

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Last Page

Think It's New? Think Again!

BY MARY SEELHORST

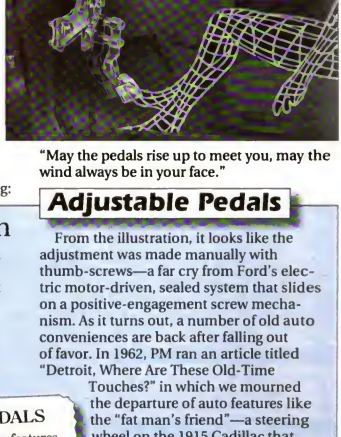
PRESENT

Assume the position: Ford Motor Co.'s new pedals rise to meet your needs.

The vertically challenged among us no doubt appreciate a better idea that Ford Motor Co. introduced on the 2000 Taurus and Sable—adjustable brake and accelerator pedals.

That's right. Not only can you adjust your seat to a comfortable position, but you can now move the pedals closer to your feet—by as much as 3 in. This enables drivers to be comfortable while still heeding airbag-era advice to sit as far back from the steering wheel as possible.

So we can now revise an old Irish blessing:



"May the pedals rise up to meet you, may the wind always be in your face."

PAST

Resume the position: These pedals rose to the occasion 90 years ago.

If you'd attended an auto show in 1910, you might have seen a crowd gathered around to observe a demonstration of the latest advancement in auto/human interface: adjustable pedals. Think it's new? Think again!

The 1908 American Simplex was a car with adjustable pedals, but we have no record of which manufacturer made the adjustable pedals shown here.

ADJUSTABLE FOOT-CONTROL PEDALS

One of the new features of automobile mechanism which attracted much interest at the automobile shows during the first part of the year, was the adjustable foot-control pedals with which one type of car was equipped. By this adjustment the driver of the auto is able to lengthen or shorten the pedal stems to suit his own individual requirements.

June 1910 Issue

Adjustable Pedals

From the illustration, it looks like the adjustment was made manually with thumb-screws—a far cry from Ford's electric motor-driven, sealed system that slides on a positive-engagement screw mechanism. As it turns out, a number of old auto conveniences are back after falling out of favor. In 1962, PM ran an article titled "Detroit, Where Are These Old-Time Touches?" in which we mourned the departure of auto features like the "fat man's friend"—a steering wheel on the 1915 Cadillac that flipped up to allow easier entry and exit. Or gloveboxes big enough to hold other boxes as well as your gloves, hood releases under the dash, retractable headlights, fender lamps, and a full complement of gauges on the instrument panel.

We may have missed adjustable pedals in 1962, but it's nice to have some of the old features reinvented for the 21st century. Even bud vases for cars have made a comeback.

Now if they'd just bring back vent windows, we'd be all set. PM

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